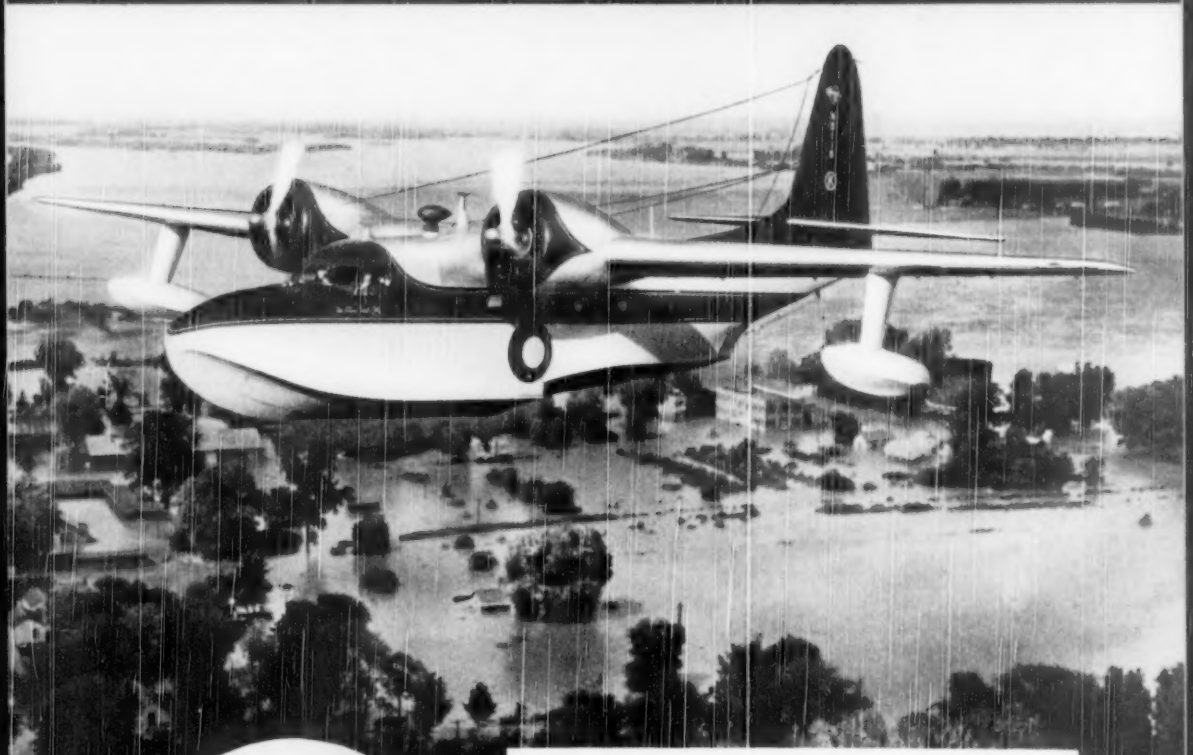
AVIATION WEEK

A McGRAW-HILL PUBLICATION

APR. 24, 1950



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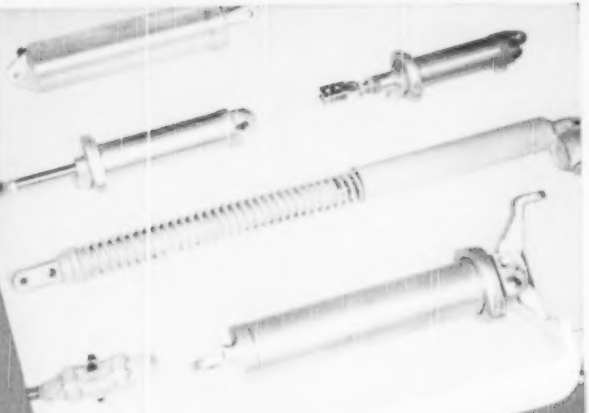

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Aviation Week

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Hamilton-Standard

18 YEARS

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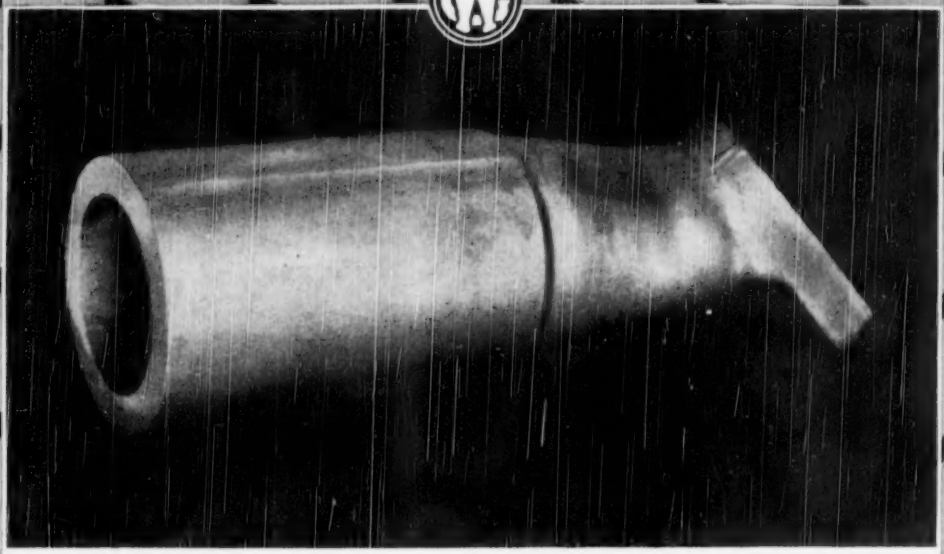
To Hamilton-Standard Division (United Aircraft Corp.) must go a large measure of credit for the aircraft progress contributed by propeller improvements. It's been Fafnir's privilege to work closely with Hamilton-Standard almost from the beginning . . . about eighteen years. There's a good reason for this mutually satisfying partnership. That reason is an attitude and an aptitude . . . a way of looking at anti-friction bearings from the designer's side, an aptitude gained from more than twenty years' specialization in aircraft ball bearings. Write for new catalog. The Fafnir Bearing Company, New Britain, Connecticut.

Fafnir thrust bearing for propeller blades, developed for Hamilton-Standard to handle the thousands of pounds of centrifugal load imposed upon the blades of controllable pitch propellers.



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NEWS SIDELIGHTS

Runway Glow

First service test of phosphorescent white paint at a major terminal is being studied at Washington National Airport. Two dual stripes have been painted on runway 33, and pilots are being asked to comment on how well the lines show up. Reports have been favorable but indicate that a wider strip is desirable.

The narrow ones may be obliterated too soon by tire marks and oil smudges. One of the delays in the use of phosphorescent paint for runways has been the development of a "non-skid" paint. If the present tests are satisfactory, look for an early repainting of all runway markings at other airports.

No. 3 Contributor

The aviation industry takes third place as the Democratic Party's financial godmother. A survey of 1949 political contributions showed that the party's heaviest contributor was the movie industry with donations totaling $68,000. The Democrats' second biggest windfall came from the liquor industry with contributions totaling $54,000. The aviation industry was in third place, with thirty, plus aviation executives and attorneys contributing $37,000. A careful check by AVIATION WEEK showed no contributions by aviation executives to the Republican Party last year. The GOP's biggest contributors were from banking, oil, mining, and metal manufacturing.

Arcata Demise

The Landing Aids Experiment station at Arcata, Calif., is now officially dead. Withdrawal of financial support by all interested agencies leaves the CAA experiment station at Indianapolis as the only one functioning at present. Airline Pilots Assn. and Air Transport Assn. want Cleveland Municipal and Newark Airports used as experiment stations. Both organizations have invested time and money at these places and feel they provide good practical test conditions. To date, CAA is definitely opposed to any shift from Indianapolis.

The government's Air Navigation Development Board recently explained why it could not sponsor continued operation of the Arcata station. It said that at least one high-intensity approach lighting system adequate for the Radio Technical Commission for Aeronautics transition program installation is already in being, and no research and development is involved in the selection of the particular configuration to be used.

ANDB stated that at least one of Arcata's high-intensity approach light systems can, in conjunction with transition program electronic aids, permit regular operations with ceiling and visibility minimums of 100 ft. and ½ mi. The board feels the value of any contribution that presently known types of visual aids can be expected to make in reducing minimums below 100 ft. and ½ mi. is highly questionable and does not warrant the large expenditures necessary to maintain the Arcata station.

Early Will Resign

Stephen T. Early is expected to resign his post as Deputy Secretary of Defense August 1, 1950, to return to vice presidency of Pullman Company. According to close associates he will retire from Pullman Company activities December 1.

Impending reorganization of Defense Department Office of Public Information including a revision of mission and strengthening of its command functions through the mission revision will be the parting gesture of Mr. Early at steadying the still wobbling unified Department of Defense.

Office of Public Information reorganization is scheduled for announcement July 1.

MATS Cut Back

Defense Department's plans to reduce transport operations of the Military Air Transport Service by one-third are being received warmly in airline quarters.

Commercial carriers have long contended that MATS should only be a "nucleus" transport organization with emphasis on training—and shouldn't be allowed to compete with the airlines even for government business. Air Transport Assn. protested vigorously several months ago when MATS announced plans to reestablish regular service to South America. Sen. Edwin Johnson (D., Colo.) chairman of the Senate Commerce Committee, quoting an AVIATION WEEK story, later asked Maj. Gen. Laurence S. Kuter, MATS commander, for an explanation of the South American expansion.

Pressure from within the military also has been brought on MATS. Gen. Joseph T. McNarney, special assistant to the secretary of defense, told MATS to economize through consolidations. Further, Army Ground Forces have eyed MATS' airline operations sourly while pointing to their own lack of adequate tactical airlift support.

Even before disclosure of the proposed change in mission, MATS discontinued its "Statesman" transcontinental passenger flights, thereby throwing added business to the airlines.

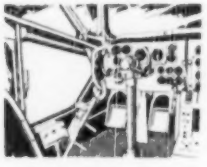
Brewster Rankled

That Sen. Owen Brewster (R. Me.), former chairman of the Congressional Aviation Policy Board, still rankles at the vacillating attitude taken by the aircraft industry on the question of government support for air transport prototypes was made quite evident at a recent Washington meeting of the Institute of Aeronautical Sciences.

The meeting was programmed as a discussion about why the aviation industry wants government support for new transport prototypes and headlined Adm. DeWitt C. Ramsey, president of AIA. But when time came for discussion Sen. Brewster took the floor and in his best senatorial manner proceeded to tell the aircraft manufacturers off for their inability to make up their minds as to whether they did or did not want government support. The senator pointed out that after the congressional board went down the line for the aircraft companies at their insistent urging in testimony before it and plugged strongly for prototype financing that the industry had changed its tune. Opposition by the industry to prototype legislation he indicated was a large factor in killing chance for its passage in the last session of Congress. The senator seemed a little amazed at the temerity of the industry for once more asking for government prototype aid.

Adm. Ramsey, picking up the pieces after the Brewster remarks were completed, did not discuss the former various positions of the industry but pointed out again that the industry wants prototype federal support now and if it can't get anything better would like to have passage of the Air Coordinating Committee bill to finance a testing program for jet prototypes for $12 million.

efficient



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AVIATION CALENDAR

Apr. 27-28—Air traffic conference, sponsored by Air Traffic Conference of Air Transport Assn., Saxony Hotel, Miami Beach, Fla.

Apr. 29-30—Fifth annual southeastern air show and exposition, Jacksonville, Fla.

May 3-4—15th National Aircraft Standards Committee national meeting, Aircraft Industries Assn. offices, Hollywood-Roosevelt Hotel, Los Angeles, Calif.

May 3-5—Organization meeting for National Aviation Conference, Oklahoma City, Okla.

May 9-20—Fourth annual technical conference of the International Air Transport Assn., Berkeley-Carteret Hotel, Asbury Park, N. J.

May 12-13—Midwestern conference on fluid dynamics and meeting of American Physical Society (fluid dynamics div.) in conjunction with dedication of new mechanical engineering building, University of Illinois, Urbana.

May 18-19—Annual meeting and third national forum of Corporation Aircraft Owners Assn., Hotel Statler, Washington, D. C.

May 19-20—Seventh annual personal aircraft meeting, sponsored by Institute of Aeronautical sciences, Lassen Hotel, Wichita, Kans.

May 23—National meeting of AIA airplane Technical Committee, Carlton Hotel, Washington, D. C.

May 24-26—Technical conference on telemetering, sponsored by American Institute of Electrical Engineers and National Telemetering Forum, Benjamin Franklin Hotel, Philadelphia, Penn.

May 25-26—Aircraft Industries Assn. board of governors meeting, Williamsburg, Va.

May 25-27—Spring meeting, Society for Experimental Stress Analysis, Hotel Statler, Cleveland.

May 27—Annual spring air regatta, Philadelphia Aviation Club, Wings Field, Ambler, Penn. (May 28 is alternate date in event of bad weather.)

May 27-30—Wright Memorial Glider Meet, South Dayton Airport, Dayton.

June 1-4—Aviation Writers Assn. annual convention, Hotel Mount Royal, Montreal, Canada.

June 8—Pratt & Whitney distributor operation and maintenance meeting, Airwork Corp., Millville, N. J.

June 10-13—National Aeronautics Assn., annual convention, Hotel Statler, St. Louis, Mo.

June 10-25—International aero exhibition, Centenary Palace, Brussels, Belgium.

July 7-8—Royal Air Force 1950 display, Farnborough airfield, England.

Sept. 5-10—Eleventh flying display and exhibition, Society of British Aircraft Constructors, Farnborough airfield, England.

Oct. 16-20—1950 annual general meeting of the International Air Transport Assn., Fairmont Hotel, San Francisco.

PICTURE CREDITS

12—G. E.; 13—G. E.; 16—Wide World; 18—Erwin J. Bulban.

NEWS DIGEST

DOMESTIC

Colonial Airlines completed on Apr. 18 its 20th year of scheduled operation without a fatality or serious injury to passenger or crew member. In the period, the line flew 310,276,067 passenger miles, carried more than 1,204,800 passengers, and made more than 455,000 landings on its 3182 mi. system.

Domestic trunkline passenger traffic during February was up more than 12 percent over the same month last year. January traffic had shown a 13 percent gain over January, 1949.

Port of N. Y. Authority commissioners authorized lease agreements with five foreign-flag airlines operating at N. Y. International Airport. Carriers are Air France, KLM, LAV, Sabena, and Scandinavian Airlines System. Leases are sequel to so-called Dewey airline settlement of Aug. 5, 1949, between Authority and several domestic airlines and BOAC.

American Airlines President C. R. Smith advocated airline use of Air Force jet bombers such as the B-45 in long haul civil cargo operations as a means of developing basic information on day-to-day use of jet transports. Writing in the AIA publication "Planes," Smith said airline operation of military jets on a "dummy route" basis would go far in helping the U. S. retain world air transport leadership in the face of gains by England and Canada.

Marshall Mars, giant Navy Martin flying boat which crash-landed at sea during a recent test flight, was a JRM-1 instead of a JRM-2 as it was inadvertently listed in News Digest last week.

United Air Lines last month flew more revenue passenger miles than in any previous March in its history. Passenger traffic was up 4 percent over the same month last year; freight rose 5 percent, express 71 percent and mail 11 percent.

Second Martin XB-51 variable-incidence-wing bomber made its first flight last Monday. Company also revealed that the first XB-51 has completed Phase I flight tests and has been turned over to USAF for Phase II tests at the company's field.

Two Airlines—Eastern and National—have asked CAB permission to remove the 10 percent extra fares now charged on deluxe Constellation and DC-6 flights. Reduction would be effective on or before June 1. EAL and NAL also hope to extend their air coach services to new points during May.

Exports of personal and executive planes of 5000 lb. and under (empty airframe weight) for March by nine companies totaled 37 valued at $200,674, compared with 21 at $256,246 listed by the same companies for February. Reporting were Aeronca, Beech, Bellanca, Cessna, Engineering & Research, Piper, Ryan, Taylorcraft and TEMCO.

Leverett Edwards, Oklahoma City attorney, has been appointed to the National Mediation Board, which handles airline disputes.

Jet transport forecasts featured the Society of Automotive Engineers aeronautic meeting in New York last week, with proponents in general agreement that the turboprop will power medium-range craft and the turbojet long-range transports. Registration for the four-day session was more than 600, and 30 manufacturers set up displays.

FINANCIAL

Glenn L. Martin Co. reported net income of $642,682 or 57 cents per share for the first quarter of 1950 on sales deliveries and billings of $10,577,404. Comparable figures for the same period last year: net income of $402,643 on sales of $12,283,265, or 35 cents per share. Current assets Mar. 31, including unrestricted cash of $10,171,540, totaled $25,684,801 as compared with current liabilities of $13,522,468. Backlog at the end of the first quarter totaled $92,118,000 (65 percent military), compared with $71,655,000 at the beginning of 1950. Current employment is up to 8400.

Consolidated Vultee Aircraft reported a profit of $2,934,496 for the first quarter ended Feb. 28. Sales totaled approximately $92 million, with approximately $77 million for the USAF and about $13 million for the Navy.

INTERNATIONAL

Handley Page Hermes 4, first of 25, has been delivered to BOAC and is being used for crew training and operational development flights. At least 23 of the type have reached final assembly stage at builder's Radlett plant. A half-dozen have been tested and inspected by BOAC and are to leave for the airline's Hurn base almost immediately. Others will follow at the rate of one per week.

Air Services of India has taken delivery on its second SNCA Sud-Ouest Corse transport. The Corse is a French twin-engine 10-13 passenger craft with 185 mph. cruising speed.

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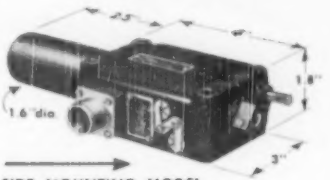

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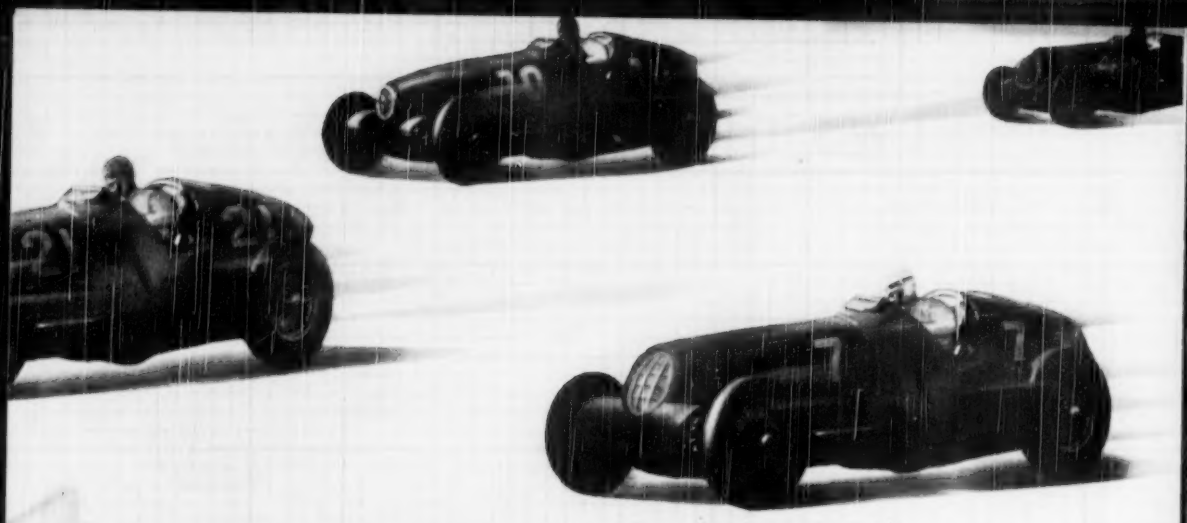

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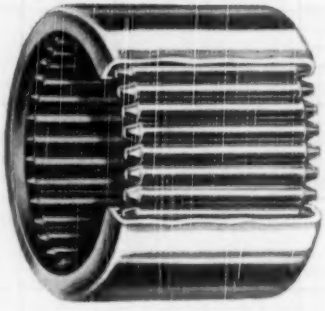

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WHO'S WHERE

Saying Good-By

Dr. Albert C. Roper is retiring next year as secretary general of the International Civil Aviation Organization. Dr. Roper has been active in international aviation more than 30 years. He was secretary of the Aeronautical Commission of the 1919 peace conference, and secretary general of the International Commission for Air Navigation 25 years.

Dr. Paul T. David has resigned as alternate U. S. representative on the council of ICAO to accept an appointment with the Brookings Institution, Washington, D. C. Since 1946 Dr. David represented this country on the Air Transport Committee, and was appointed U. S. alternate representative the following year. In 1948 he was elected chairman of the economic commission at the second annual session of the ICAO assembly in Geneva. Shortly thereafter he served as chairman for the initial year of the reorganized 12-member Air Transport Committee.

Changes

► **Around the Manufacturers**—**James W. Roche** has been appointed supervisor of customer field service for Northrop Aircraft and will supervise field service on the F-89 Scorpion all-weather interceptor and the C-125 Raider transport . . . **William G. Key** has joined public relations staff of Fairchild E&A Corp. and will continue as editor of the company's house organ, "The Pegasus," in addition to other assignments in Washington, D. C., and Hagerstown, Md. . . . Aviation division of Goodyear Tire & Rubber Co. has made following changes: **J. E. Leonard** has been named district manager with hq. at Dallas, Tex.; **R. H. Hill** has been assigned to the Akron office in charge of Goodyear's contacts with the lightplane industry and also will coordinate activities of the division's field men with the plant; **C. H. Bruns** has been transferred to manufacturers sales department working out of Kansas City . . . **Albert E. Smyser, Jr.**, formerly of Fairchild's NEPA division, has been made public relations staff asst. at Glenn L. Martin Co. . . . **Edwin P. Foltz** has been named asst. industrial relations director of Pesco division of Borg-Warner Corp.

► **Around the Airlines**—**Eugene T. Thummel** has been named supt. of passenger service for Pioneer Air Lines with hq. in Dallas. He replaces Jay G. Rupe, who resigned . . . **Jack Flynn** has been appointed district sales manager for Northwest Airlines in Newark, N. J.

Travel Log

Beverly Howard, top-ranking acrobatic pilot has left for France to fly in a series of stunt exhibitions against Europe's top pilots. He is scheduled to fly his Warner-powered Bucker Jungmeister biplane at Paris, Apr. 30; Sarrebruck, May 7; Toulouse, May 14; Rouen, June 4; plus other dates not yet announced. He also plans a brief visit to Pakistan by airliner in June.

INDUSTRY OBSERVER

► **New Allison J-35-A23 turbojet engine is actually rated at 9700-lb. thrust instead of the 9200-lb. thrust previously quoted.**

► Designation of YB-56 has just been given to the four-jet version of the Boeing Stratojet sweptwing bomber, replacing the original designation of B-47C. The new tag indicates the plane is scheduled for production sooner than was heretofore expected. It is powered with four of the Allison J-35-A23 engines instead of six GE J-47 engines (rated at 5200-lb. thrust each).

► **Airframe companies will get only about half of the $1.2 billion announced by the USAF for 1950 plane procurement, while the rest goes to engine, propeller, accessory and equipment manufacturers.**

► British Bristol 173 feederline helicopter will be first modern European helicopter to adopt tandem rotor configuration, and is being slated for use on British European Airways system after experimental development. The Model 173 is designed to carry 10-12 passengers, and will be powered by two of the Alvis Leonides 550 hp. radial engines which have become standard helicopter powerplants in Britain. Prototype is not expected to be ready for first flight until the summer of 1951. Meanwhile Bristol continues with its successful smaller 171 single-engine helicopter and BEA will begin June 1 to use Westland-Sikorsky S-51s on a scheduled service between Liverpool and Cardiff.

► **Score of 90 Thunderjet F-84s "shot down" in the "attack" on Vieques Island during Operation Portrex was credited by official umpires to Marine Squadron VMF-115 using Grumman Panther F9F-2 jet fighters, with only 9 Panthers lost in the defense.**

► Douglas Aircraft hopes to fly one of the first C-124A transports down to Operation Swarmer at Camp Mackall, N. C., late in April. The big four-engine transport would not be used in the exercise, but will probably be on display as a sample of bigger aircraft soon to be available.

► **Bell Aircraft studies show that higher tip speeds for helicopter blades up to over 700 fps. are practical, but researchers feel additional studies are necessary on use of high tip speeds since standard airfoil data is not completely applicable to rotor blade problems. Drawback is that the advancing blade of the rotor is at high Mach number only instantaneously, and then at a low angle of attack; other airfoils are subject to more constant speeds.**

► A dive at 185 mph. (in excess of Ercoupe design requirements) was cited as the cause for structural failure of a 1950 Ercoupe near Riverdale, Md. Pilot Robert Sanders bailed out at 4000 ft. and suffered a broken leg and head cuts. He had previously completed a dive test of 165 mph. (also above design requirements) in the same plane. Sanders, head of Sanders Aviation, National Ercoupe distributor, has flown most of the tests on the Ercoupe since early prewar prototype days.

► **Cook Cleland, twice winner of the Thompson Trophy at the Cleveland National Air Races, is working on a plastic float for light planes, expected to be manufactured at Cleveland by an associate, Joe DeOlloqui, owner of a plastics plant.**

► The two J-35 engines in the Hughes XH-17 jet helicopter were specially modified by General Electric to siphon off most of the compressed air to the rotor blades. GE removed the last few stages of the compressor and substituted an annulus to collect the air. This air is piped through the rotors to orifices at the blade tips where it is mixed with fuel and burned to provide thrust for the blades. The rotors are free wheeling with no gears. The GE modification permits just enough air to flow to the combustion chambers to give the turbine power to turn the compressor, without furnishing any thrust.

► **Industry sources are wondering about the apparent omission of Beech and TEMCO trainers from the 1950 USAF procurement list. It was generally understood that the USAF was ordering three each of the Beech T-34 Mentor and the TEMCO T-35 Buckaroo. Yet neither was listed nor was their principal rival for the small trainer business, the Fairchild T-31.**

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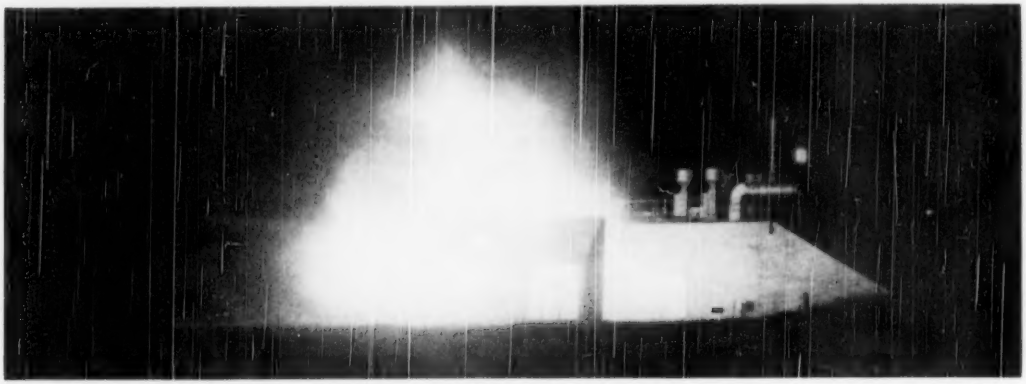


TEST FACILITIES such as GE's rocket motor firing pit at Malta aid in developing guided missiles, but volume missile output is far off.

$100 Million Missile Program Under Fire

With no production in sight, Congress tells Defense Department to investigate.

By Ben Lee

Sweeping investigation of Defense Department's entire guided missile program is building up based on a stream of unofficial reports to Congress over inequities in service leadership of the $100-million-plus program.

Congress has ordered the Defense Department to examine its missile research program. Order is based on reports from research scientists through the nation, appalled at gross duplication of effort and allocation of funds to facility projects for which there is no adequate use seen within the next five years.

► **Background**—For the first time the military has had sole responsibility for a development in which there has not been and does not seem to be commercial civilian industry interest (at least in the near future). As a result, Defense Department's Research and Development Board, charged with overall rule of missile development, has cloaked all data pertaining to rockets under tight security.

Congress has had no quarrel with development cognizance as constituted under R&DB's organization. Secrecy of specific weapons has been guarded, for status of the missile as a weapon could well decide the impetus to war—or force an aggressor to hold off its attack.

Congress has, until of late, left the military pretty much to its own devices in missile development because of military science's convincing argument that no stone in basic missile research should be left unturned. According to Capitol Hill sources so many "stones" have been turned however, that R&DB's Committee on Guided Missiles has been unable to concentrate development in definitive channels and progress has been slowed.

Recently completed USAF Stuart Report (AVIATION WEEK, March 6) representing a survey of the entire Missile Program is now before the Joint Chiefs of Staff. While many of the problems considered by the Stuart Committee resulted in split decisions the report recommended elimination of five guided missile development contracts and consolidation of six other separate missile projects to three.

Defense Department, though not concerned directly with Stuart Report, was displeased with inability of Stuart Committee to concur in the report's entirety and coupled with a congressional request, organized its own survey board to examine R&D activities in the guided missiles field. While report of the individual teams have not as yet been completely correlated, preliminary indications are that almost without exception each examined agency agreed that there is exhorbitant waste and little real progress in missile research and development.

It was reported that of the nine supersonic missile projects under development for air defense operations, two will not be ready for testing until 1951; two others will not be ready for test until 1952; three are scheduled for test in 1953 and two others will not reach the experimental test stage until late in 1954. Most familiar of the air defense-type rockets under test is Boeing's GAPA missile which is being developed for Air Force. Model test vehicle research has been concluded. Overshadowing prototype test performance has been its utilization by the military to recapture waning congressional and public interest in expensive missile research. Publicity was spectacular and succeeded in bolstering Defense Department's policy-for-the-public, that adequate progress was being made. Actually, the proposed GAPA is a 5000 lb. ground-to-air missile with 200 lb. warhead scheduled for a Mach 2.5 speed developed by ramjet propulsion. It will not be available for service test for nearly two years.

Navy is developing an air-to-air missile which it identifies only as Meteor. It is an airborne missile for fighter craft and will weigh 500 lb. It will have a Mach 3 speed and a 25 lb. warhead. Powered by liquid rocket propulsion, it is currently undergoing guidance tests but

will not be available for service test until 1953.

▶**Combat Air Support**—There are six guided missiles scheduled for combat air support. Five are Navy developments and the sixth is Air Force. Two are air-to-air, one is air-to-surface and three are air-to-underwater. Two missiles in this category are little more than refined models of conventional air-to-surface bombs.

Others in this category, with exception of Hughes Aircraft's MX-904 rocket which is scheduled for test late this year for Air Force, will not be available for testing for at least five years. Navy Oriole, for example, which will weigh approximately 1500 lb., will have an estimated speed of Mach 3, and a range of about 20 mi. Also powered by ramjet engine, it is not scheduled for test until late 1955.

▶**Land Operations**—Of the seven missiles under development for land combat operations, five are in development by Army, one by Air Force and one by Navy. Navy's development is scheduled for amphibious use and is known as LaCrosse. To be used against shore installations it will weigh about 1200 lb. and will be powered by a reciprocating engine which will give LaCrosse a 250-mph. speed. It is scheduled for test in 1954.

Best known of missiles intended for land combat operations is the Douglas WAC Corporal under Army cognizance. Currently undergoing evaluation tests, it is one of the few rockets which could be engineered for immediate emergency use. It weighs approximately 11,000 lb., has a range of about 50 mi. and a speed approaching Mach 4.

Another development closely paralleling the WAC Corporal is Hermes A-1. Chief difference is that it weighs approximately 7000 lb., is slightly slower and is said to be capable of conversion from present test vehicle stage to operational service use by 1952. Hermes II and Hermes A-3 are "heavier" versions of the same basic weapon. Hermes II weighs approximately 25,000 lb. and Hermes A-3 about half that. Neither will be ready for service test before 1952.

In the field of development for sea combat operations there are 8 missiles in various stages of research, all of which are under Navy cognizance. Three of the eight missiles under development are actually weapons which were developed during later stage of World War II and are in current development only for component testing of devices for other missiles. The remainder of Navy developments is not scheduled for testing for at least two years.

Eleven guided missiles are under development for strategic air operations. Nine are under Air Force cognizance, one Army and one Navy. Three of USAF's "missiles" are air-to-surface bombs refined from war-time prototypes. The remainder are not scheduled for test for from three to five years.

Factually, to date there is but one "guided missile" capable of immediate emergency use. This is Banshee, a Boeing B-29 drone which can carry a 10,000-lb. bomb load at 250 mph. Range is approximately 3000 mi. (Operating mechanism of the Banshee is adaptable to other large planes.)

This is cause of congressional unrest and what has provoked impending investigation. With more than $300 million spent in missile research and construction of elaborate test facilities since 1946 neither Air Force, Army nor Navy have come up with one adequate prototype guided missile.

Reasons attributed by research scientists are:

- **Duplicatory research** has drained 40 percent of the dollar effort placed in missile research.
- **Test facilities** for which there is no adequate project return foreseen in next three to five years, have cost Air Force and Navy millions.

Inyokern, a multi-million-dollar test facility built for Navy in a remote area on the West Coast is running at less than half-capacity.

This is principally due to Navy's inability to interest sufficient scientists and technicians to migrate to so remote an area. USAF's development of Banana River, Florida, joint long range missile test center has been cited as another case in point. There is not, according to reports received on Capitol Hill, a missile in research which has reached a sufficient stage of development to require the tremendous expenditure of funds asked by USAF for emergency development of the Banana River installation.

Two other installations, Point Mugu, California, in operation for several years, and Air Engineering Development Center which Air Force now has under construction in Tennessee are also scheduled reevaluation. Point Mugu, operated by Navy, is doing its job well according to reports but many of its activities are duplicated elsewhere and with the proposed development of USAF's Banana River installation its activities would be duplicated completely.

Research scientists are not all convinced that there is a need for AEDC as it is presently planned. Objections to the installation arise from proposed use of wind tunnel equipment which is felt to be inadequate in the high subsonic and supersonic ranges because of size of instrument and model test sections. It was also noted by those interviewed that the remoteness of the AEDC project area would present USAF with the same difficulty in staffing the plant as Navy has faced with its Inyokern installation.

TEST CELL at GE's Malta station, with flame pit at right fires motors.

Missile Motors Work Gets Results

Showing off its test station, GE joins Army Ordnance in claiming U. S. has increased rocket engine efficiency.

The question of how far American rocket motor development has progressed since the end of the war has been answered in exact terms by the Army Ordnance Department and engineers at the General Electric Co., Schenectady, N. Y.

The efficiency of rocket motors developed by GE is at least 10 percent greater than that of German models built at the end of World War II, GE claims.

▶**10 Percent Gain**—American rocket motors have reached a least 90 percent efficiency, against 80 percent reached by the Germans, five years ago. GE

rocket experts point out that this 10 percent gain is a significant increase in view of the fact that engineers must fight for every fraction of a percent increase in efficiency when nearing the 100 percent mark. One-hundred percent efficiency would be realized if the input (propellant) to the motor were converted 100 percent into output (thrust).

Translated into payload and range, the 10 percent gain means that American guided missiles comparable in size to German World War II models now can carry warheads at least 40 percent heavier, or fly 20 percent farther.

In round terms, GE says its rocket motor research program has reached a point where "large-scale power plants of higher efficiency, less weight and greater reliability than World War II motors can be built."

▶**"Hermes" Project**—This information was revealed earlier this month when GE and the Army opened the door for a few hours to GE's jealously guarded Malta Test Station, Malta, N.Y. GE is one of several contractors under the Army's rocket research and development program.

Newsmen invited to the Malta station, where all rocket motors developed by GE under the so-called "Hermes" project are tested, witnessed the firing of a 16,000-lb.-thrust rocket motor held stationary in a special test rig during the firing run. Firing time was not over 30 sec., but it was long enough for recording devices to pick up the desired performance data. The motor burned liquid oxygen and alcohol.

▶**Little Giant**—While this particular unit has a much higher thrust rating than any turbojet engine, it is only 3 ft. long and 8¾ in. in diameter at the headplate (nozzle). (The largest production turbojet in the U.S. is the 8,000-lb. Pratt & Whitney J-48.)

The motor demonstrated at Malta points up the trend in this country towards smaller, high thrust units operating at high temperatures and pressures. The Germans seemed to be going toward larger sizes at the end of the war. The V-2 motor, for instance, had a cluster of 18 nozzles feeding into a common motor body, while development at GE seems to favor compact, single-nozzle motors.

Three factors contributing to better motor efficiency and smaller size are improved high-strength, high-temperature metals, improved propellants having high flame speed and combustion temperatures, and better cooling methods, GE says. But cooling and need for improved metals remains an extremely critical problem in trying to achieve higher performance.

▶**What Happens at Malta**—GE's facility at Malta is purely a test base. A rocket motor may be put through 20-30-sec. firing tests several times at Malta to check various phases of performance and to collect data for refinements in a particular unit. After GE has built a motor and tested it at Malta the motor is sent to White Sands, N. Mex.

Dr. R. W. Porter, head of the project, says GE has several new rockets in various stages of development for the Army. An experimental motor destined for White Sands is a finished article by the time it is shipped. Design and construction of these units depend on joint effort of several GE departments. Some refinements in construction—shown to be needed by test firing—can be made in the Malta station's own machine shop.

Malta also is conducting experiments with various propellants, including hydrazine, hydrogen peroxide, boron hydrides and gasoline, in addition to liquid oxygen and alcohol.

Diborane, a boron hydride, gives considerably better performance than alcohol and has an "extraordinary flame speed," says Dr. Porter. It has a combustion temperature of about 6800 degrees F.

GE also is conducting research in the field of ramjet-propelled guided missiles and holds a contract with the Army to assemble components of V-2s captured in Germany, make parts which may be missing or defective and supervise technical aspects of the launchings at White Sands. Engineers say study of the V-2 aided considerably in starting GE's rocket development program.

▶**Malta Equipment**—Malta station, the first of its type in the U.S., has been in full-scale operation more than three years, but the first test at the site was made in 1945. It can handle rocket motors up to 50,000 lb. thrust.

The installation consists primarily of four test pits and subsidiary structures. They are in a heavily wooded, isolated 3000-acre tract near Schenectady and are operated by 150 persons, mostly GE employes.

Two of the test pits from the outside look like concrete bunkers used to store explosives: constructed of reinforced concrete and set in the forward slope of a hill with earth heaped over the top and around the sides. But there's no resemblance internally.

▶**Inside the Pit**—Each test pit is divided into four sections—control room, motor room and two "reactant" or fuel rooms. The control room contains fuel regulators, data recording devices and other equipment required to conduct the firing runs. Specially calibrated tanks permit constant electronic measurement of fuel consumption in the "reactant" rooms. Tanks are protected from fire or explosion by ventilating fans and high-pressure water nozzles which operate automatically or manually.

The motor room has only three walls, so that exhaust gases from the rocket motors spurt through the open end. A few yards back of this opening is a flame deflector screen made of concrete and heavy wire mesh. This flare baffle breaks up exhaust flames when they go beyond the walls of the motor room.

▶**Vertical Pits**—There are two newer and larger test installations where motors are mounted vertically and fired downward into concrete flame pits 60 ft. deep and containing water. Engineers control and observe firing in the vertical test pits from a control building about 100 ft. from the test stand.

Control rooms for all four pits are protected by concrete walls 3 ft. thick on the side facing the rocket motor. All other walls and roofs are 2 ft. thick. Observation windows are 3 in. bullet proof glass panes, abutted on each side with 2-in. steel plates. There never has been a serious accident at Malta.

During firing tests, a string of bright "diamond" spots could be seen in the core of the exhaust, caused by the supersonic speed of the jet. During the blast, the rocket exerts pressure on the adjacent steel framework and this pressure is transmitted electrically from the framework to a recording graph.

▶**Water Test**—Before a rocket is fired water is pumped through the nozzle to make certain the system is clear. This water test also can be used to determine the pressure required for the fuel flow. In a demonstration, the water was pumped into the rocket motor at the equivalent of a fuel consumption of 70 lb. per second.

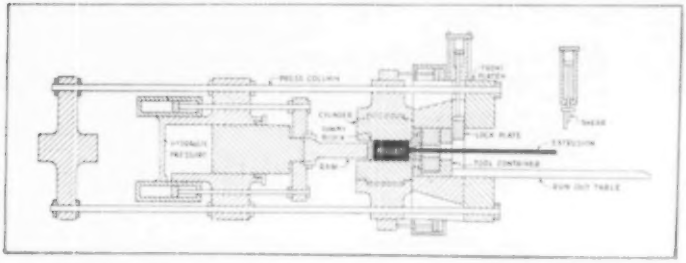
The 16,000-lb.-thrust motor fired at the demonstration had two fuel lines, one for liquid oxygen, the other for the alcohol. The alcohol line fed into a jacket around the motor body. This arrangement serves a double purpose: the alcohol cools the motor and at the same time is preheated before injection. The liquid oxygen flows directly to the headplate.

Aircraft Research Activities Polled

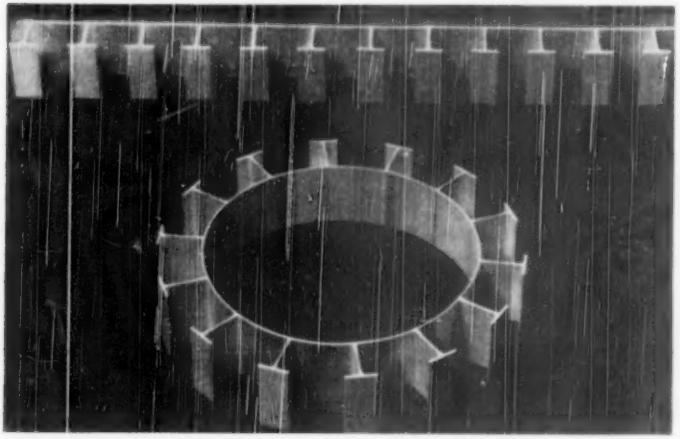
In a survey of the research requirements of American industry, 71 percent of the aircraft companies polled stated that they would not curtail their technical staffs even in the event of a reversal of the present growing economy.

Should the present condition of the national economy continue, only 29 percent of the aircraft industry stated it would increase future research activities, while 14 percent stated research would be decreased and 57 percent predicted an increase.

SKIN AND STIFFENERS are squeezed out in one long roll in one operation from . . .



EXTRUSION PRESS with 5500 lb. pressure behind ram. Skin emerges from press as . . .



RIBBED CYLINDER which, then is cut lengthwise, straightened and stretched.

Aircraft Fabrication Revolution?

By Alexander McSurely

Important new trend in U. S. aircraft manufacturing methods which will have a major effect on future airplane design and fabrication is forecast as a result of the development to commercial stage of a new Reynolds aluminum extrusion process announced last week.

The revolutionary new process actually squeezes out airplane skin for wings and fuselages complete with built-in stiffeners thus creating a new semi-finished material for planes which promises to take many of the tedious man-hours and high labor costs out of airplane fabrication.

Reynolds Metal Co. engineers demonstrated recently to leading airplane manufacturers' engineers and to top USAF industrial planning specialists at Phoenix, Ariz., that their new extrusion process can turn out ribbed sheet suitable for airplane wings and fuselages from 75S alloy, the tough material selected by modern designers for the higher stresses to which high speed planes are subjected. The ribs are integral reinforcements at regular intervals along the sheet, and so designed that no other structural beefing is required to take the loads put on fuselages and wings in flight.

▶ **Simple Fabrication**—Potential of the new process for aircraft structures is enough to start the most stolid aircraft designer to penciling doodles on an envelope.

Without requirement for internal spars and bracings, the new material is expected to make it possible to shape plane wings and fuselage structures by far simpler fabrication processes, and at far more rapid production rates than is possible with present flat sheet materials and methods.

"The extruded sections," says Lt. Col. Carl W. Andrews, chief, resources planning section, industrial planning division, AMC, "have high physical properties and because of excellent detail configuration they will carry high compression stresses even with widely spaced supports; thus both weight advantage and simplification of internal structure can be obtained."

▶ **Ribbed Cylinder**—Using a hydraulic extrusion press with 5500 tons pressure behind the ram, the Reynolds demonstrators squeezed out through a die a long, ribbed cylinder with an inside diameter of 8.858 in. and a circumscribing circular diameter of 11.86 in. Slit lengthwise, the cylinder was laid out by a series of straightening and stretching processes to become a flat aluminum skin nearly 28 in. wide, weighing 5.784 lb. per sq. ft. with 14 T-shaped integral stiffeners running longitudinally at equally spaced intervals. Various skin thicknesses such as 0.04 in. and 0.07 in. have been used.

The section, according to Dr. George Perkins, Reynolds director of technical services, has been extruded successfully in 61S, 24S and 75S alloys and is considered commercial.

▶ **5 ft. Sheet**—Perhaps a 28-in. ribbed sheet is too narrow; if so, Reynolds engineers say they can make a comparable ribbed sheet up to 5 ft. in width by use of a larger press with approximately three times as much pressure.

To make a cylinder of sufficient internal diameter (20 in.) a 15,000 lb. press would be required to ram the extrusion out. When cut lengthwise and flattened, such a cylinder would make a skin approximately 5 ft. wide.

▶ **Future Lengths**—With present equipment a single section of SK-562, the experimental extruded cylinder shown, can be produced to a length of about 25 ft. with possibility of increasing this to a future length of 35 to 40 ft. Length of sections is governed by the maximum weight of aluminum alloy billets, now

175 lb. Possibility of increasing this to 250 lb. is under consideration.

Thicknesses of skin up to ¾ in. will be required for some designs under consideration, it was reported at the demonstration, but these presumably can be produced with suitable dies and sufficient pressure.

▶ **Lockheed Experiments**—Analysis of experimental work at Lockheed Aircraft in forming extruded sheet with integral stiffeners, presented by George W. Papen, showed that on an average, structures built with the new material weighed about 10 percent less than conventional structures.

Even more significant was the finding that the number of attachment operations and of separate parts was reduced 60 percent as compared to conventional design.

▶ **Small Bends**—Papen said that forming methods using both stretch and compression rubber forming had been successfully used and that the compression method was particularly suited for forming airfoil sections involving small bend radii out of the integrally stiffened sheet.

Average cost reduction on a basis of quantities ranging from 50 to 500 units, amounted to about 10 percent. Most estimates for stiffened sheet structures ranged from less than 50 percent to over 150 percent of the cost of conventional structures. However, high relative cost was accompanied by weight reduction, with a maximum premium per pound of weight saved of $2.

▶ **War Availability**—The Lockheed engineer pointed out that availability factor of the new material in case of war, was even more important than weight and cost reduction factors. Production techniques made possible by integrally stiffened skin will require only a small fraction of the aluminum ingot capacity and machine tool capacity which are required for wing and fuselage skin built up of many fabricated parts held together by multiple rivets or spot welds, or made of solid metal, milled to required dimensions.

Papen called for requirements of rolled and forged stiffened sheet in addition to extruded stiffened sheet. He estimated that Lockheed could use integrally stiffened sheet of these three types for about 70 percent of its production, replacing riveted stiffeners.

▶ **Dow and Alcoa**—It was pointed out that somewhat similar magnesium extrusion development had been made by Dow Metals in 1940, and that the Alcoa had produced a smaller extrusion of 5S alloy as early as 1933, but that the Reynolds achievement with 75S alloy made possible new attainments in aircraft structural design.

Other significant points discussed at the Phoenix demonstration:

• **Integrally stiffened** skin sections of sizes and designs available with present presses will probably not be adaptable to all manufacturers' wing designs.

• **Good potential applications** for integrally stiffened skin include: fuselages, bulkheads, floors, side panels and bottoms of flying boats, and guided missiles. (Possibility is seen for extruding the complete fuselage of a missile as a cylinder, without the flattening process.)

• **Best production technique**, it was indicated, would be for the cylindrical sections to be flattened at the extrusion mill, prior to forming and heat treating at the aircraft plant (except in the case of a missile fuselage cylinder). Flatness and straightness tolerances will be needed.

• **Maximum 28-in. width** produced with present press is reduced to 24 in. after trimming and while this is acceptable for many present applications, greater widths are desirable and will result in additional structural economy.

• **Transverse properties** of the sections after flattening and stretching require additional investigation.

• **Similarly produced magnesium** sheet with integral stiffening is desired for many interior applications.

The demonstration at the Reynolds Phoenix plant was the result of a manufacturing-methods contract let by AMC to Reynolds more than a year ago, after the aircraft industry had expressed interest in this type of structurally reinforced material in a 1948 survey conducted by the technical service of the Aircraft Industries Assn.

Significance of the new development to the industry was shown by the turnout of top engineers, structural experts and designers from major aviation companies including: Bell, Boeing, Consolidated-Vultee, Douglas, Lockheed, Chance Vought, Fairchild, Goodyear Aircraft, Hughes Aircraft, Glenn L. Martin Co., McDonnell Aircraft, Curtiss-Wright, Northrop, North American, Republic and Ryan. Alcoa and Kaiser Aluminum and Chemical Corp. also were represented. Boeing sent five engineers, while Convair and Lockheed each sent three.

Military delegation led by Brig. Gen. A. H. Johnson, industrial planning division chief, AMC, included Cols. Leigh Hunt and Omer Niergarth of the Munitions Board staff, several Navy industrial planning representatives, and additional officers and civilian specialists from AMC.

Political Gifts

Financial contributions of aviation personalities going to Democrats.

Aviation executives are turning a cold financial shoulder on the Republican Party and pouring political contributions into Democratic hands.

Survey of 1949 contributions to finance this year's Democratic campaign show these donations:

James Bruce, American Airlines director and stockholder (former Ambassador to Argentina, now director of the European

CONVAIR ENGINEERING INGENUITY

First flight tests were made last week at Ft. Worth with an experimental nacelle carrier built to carry four Pratt & Whitney R-4360 engines suspended below the bomb-bay of a Convair B-36 bomber. Two complete nacelles are enclosed in each of two cylindrical pods, each 32 ft. long and 8 ft. in diameter. Pods are attached to an airfoil-shaped beam suspended just forward of wing leading edge. Nacelles are bolted on to beam with same 4-bolt attachment with which nacelles are normally mounted on a B-36 wing. Arrangement makes it possible for B-36 to carry four spare powerplants for its own use to bases as needed. Carrier fully loaded weighs 25,000 lb. Preliminary design of carrier was at Convair Ft. Worth with detail and fabrication at Convair, San Diego.

Arms program) $4000. (His brother, David Bruce, now Ambassador to France, contributed $2000.)

Robert Six, president, Continental Airlines, $2500.

E. Smythe Gambrell, attorney, Eastern Air Lines, $2000.

Allan T. Chase, president, Standardized Aircraft, $1000.

Robert Hinckley, former assistant secretary of Commerce for air, now vice president, American Broadcasting Co., $3156.

Robert Thatch, airline attorney, $2500.

C. R. Smith, chairman of the board, American Airlines, $2250.

Thomas Morgan, Chairman of the board, Sperry Corp., $2000.

W. D. Pawley, former Ambassador to Brazil, now an executive of central Aircraft, $1000.

George Whiteside, attorney, TWA, $1000.

Robert L. Earle, former vice president, Curtiss-Wright Corp., $1000.

Sigmund Janas, President, Colonial Airlines, $1000.

G. W. Vaughan, former president, Curtiss-Wright Corp., $1000.

Herbert Gleitz, president, Marquette Metal Products Co., Curtiss-Wright subsidiary, $1000.

Joseph Kennan, former counsel, House Armed Services Committee (for its B-36 investigation), $1000.

J. Carroll Cone, assistant vice president, Pan American Airways, $1000.

L. Welch Pogue, World Travel, Inc., Aviation attorney and former chairman, Civil Aeronautics Board, $1000.

Sullivan, Bernard, and Shea, Airline attorneys, $1000.

A. R. Christie, Washington representative, Pratt and Whitney aircraft, $1000.

Martin Scanlon, Washington representative, Republic Aviation Corp., $1000.

Harry Playford, President, U. S. Airlines, $1000.

Sherman Fairchild, director, Pan American Airways and Fairchild Engine & Aircraft Corp., $500.

Floyd Odlum, chairman of the board, Consolidated Vultee Aircraft Corp., $500.

Thomas Bourne, aviation consultant, $500.

T. Peter Ansberry, attorney Colonial Airlines, $600.

A. L. Wheeler, airline attorney, $400.

James Francis Reilly, airline attorney, $250.

J. Earl Cox, CAB examiner, $250.

Max Truitt, airline attorney, son-in-law of vice president Barkley, $200.

Richard Boutelle, president, Fairchild Engine & Aircraft Corp., $200.

D. W. Rentzel, Administrator of Civil Aeronautics, $250.

Jack Frye, former TWA president, now president, General Aniline and Dye, $100.

W. A. Patterson, president, United Air Lines, $100.

O. M. Mosier, vice president, American Airlines, $100.

Lewis C. Burnwell, president, Resort Airlines, $100.

Warren Lee Pierson, chairman of the board, TWA, $100.

A can-ful check showed up no contributions to the Republican Party by aviation officials. Robert Lovett, former assistant secretary of war for air, contributed $300 to the GOP.

List Top Aircraft Industry Salaries

Top salaries paid by seven aircraft manufacturing firms during 1949 are listed in a second partial survey by AVIATION WEEK. (Ten other companies' salaries were reported in the April 10 issue and additional companies will be listed later.)

Salary details:

▶ **Boeing Airplane Co.**—William Allen, president, $60,050, plus incentive payments of $1429 cash and $1071 stock; Wellwood Beall, vice president, $35,025, plus incentive payments of $1284 cash and $966 stock; Fred Landan, vice president, $28,085, plus incentive payments of $1284 cash and $966 stock; J. E. Schaefer, vice president, $28,005, plus incentive payments of $957 cash and $693 stock. Total payment to officers and directors: $274,135, plus incentive payments totaling $8204 cash and $6111 in stock.

▶ **Republic Aviation Corp.**—Mundy Peale, president, $61,000; Alexander Kartveli, vice president, $47,150; Thomas Davis, secretary, $30,000. Total payments to officers and directors: $199,250.

▶ **United Aircraft Corp.**—H. Mansfield Horner, president, $103,100, plus $40,000 incentive payment and $7610 retirement payment; Frederick Rentschler, chairman, $103,450; Leonard Hobbs, vice president, $73,400, plus $30,000 incentive payment and $7565 retirement payment; Raycroft Walsh, vice chairman, $63,350, plus $20,000 incentive payment and $8736 retirement payment. Total payment to officers and directors: $683,350, plus $202,500 in incentive payments and $52,653 in retirement payments.

▶ **Lockheed Aircraft Corp.**—Robert Gross, president, $75,200, plus $11,819 pension payment; C. A. Barker, vice president, $60,350, plus $12,292 pension payment; Courtlandt Gross, vice president, $60,350, plus $5773 pension payment; Cyril Chappellet, vice president, $45,300, plus $4050 pension payment; Hall Hibbard, vice president, $45,000, plus $4508 pension payment; Herbert Ryker, vice president, $45,353, plus $9173 pension payment; Carl Squier, vice president, $45,000, plus $9685 pension payment. Total for officers and directors: $476,944, plus $62,702 in pension payments.

▶ **Grumman Aircraft Engineering Corp.**—L. R. Grumman, chairman, $50,200, plus $9718 retirement payment; L. A. Swirbul, president, $60,200, plus $10,141 retirement payment; William Schwendler, executive vice president, $40,200, plus $5716 retirement payment; E. Clinton Towl, vice-president, $27,150, plus $3597 retirement payment. Total for officers and directors: $211,300, plus $33,919 in retirement payments.

▶ **Fairchild Engine and Airplane Corp.**—Richard Boutelle, president, $39,012, plus $20,000 bonus; Arthur Flood, vice president, $19,371, plus $10,000 bonus; Myron Gordon, vice president, $36,600; Lawrence Richardson, consultant, $36,600; J. Carlton Ward, chairman of the board to July $90,600, plus $52,092 bonus payment. (The company anticipated that this amount would be claimed by Ward, but may be contested by the company. It represents $600 director's fee; $65,000 salary; $25,000 severance pay; $52,092 bonus from the firm's profits.) Total payment to officers and directors: $297,954, plus $91,592 in bonus payments.

NACA Program Moves Forward

Chopping $11 million from the Budget Bureau recommendation, the House Appropriations Committee approved a $66-million 1951 fiscal year appropriation for National Advisory Committee for Aeronautics.

The committee called on NACA, which has expanded from a $25,000,000-a-year operation in 1945, to start "leveling off" its activities.

The $66,390,630 ($56,390,630 cash and $10,000,000 contract authorization) approved by the House group compared with the $77,600,000 ($62,600,000 cash and $15,000,000 contract authorization) recommended by the Budget Bureau.

SIEBEL COPTER NEARS CERTIFICATION

S-4 Copter developed by Siebel Helicopter Co., Wichita, Kans., shows its features in this flight view. Note cargo location directly beneath main rotor. Certification was due yesterday. Development and certification costs are estimated at $80,000, work being done in less than two years by four men. The company hopes to market the S-4 for about $10,000 and is tooling up with that figure in mind. Supercharging allows the helicopter adequate hovering performance at altitude.

SUPER CUB TAKES OFF, with dust bin open, over 20-ft. barrier 150 ft. from start.

TANDEM WHEELS of plane help in takeoffs and landings from very rough strips.

New Super Cubs Display Utility

Piper shows Model 105s, said to take off and land in less space than any approved type now available.

By Erwin J. Bulban

Piper this year is going all out to sell the new 105 Super Cubs on their high utility merits. Steep takeoffs and landings out and into small areas and slow flight speeds of the agricultural and tandem-wheel models were stressed recently by the company during demonstrations at Flushing Airport, N.Y. The company claims that these planes will take off and land in less space than any other certificated aircraft now available.

► **Innovations Help**—These Super Cubs have increased power (108-115 hp. Lycomings) and flaps. The potent effect of these innovations was displayed in takeoffs over a 20-ft. barrier from a marked-out strip only 150 ft. long. Landings were made in approximately half that distance. During slow flight, speed was down to just over 30 mph. The planes were fitted with fixed-pitch metal Sensenich props. Wind was relatively light, about 5-10 mph.

The tandem-wheel model repeatedly made short takeoffs and landings using an unprepared and very rough portion of the field.

The craft were lightly loaded, each carrying only the pilot, while the dust/spray edition had only a portion of its up-to-1000-lb. dust capacity. However, Piper says that fully loaded to a CAA-approved gross of 1500 lb. the Super Cubs 105 will take off in 575 ft. in still air and land in 385 ft. Basic price of the craft is $2995.

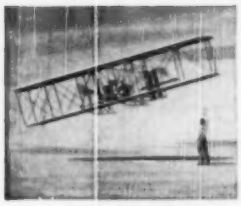
Several liaison officers watched the demonstrations unofficially and stated that they would prepare an informal report on the display.

► **Prices**—The agricultural plane with the dual-purpose dust/spray installation is tagged at about $4100. The aluminum tank has a capacity of 80 gal. of chemical or 600 lb. of dust. The dust/spray combination was designed and is being supplied by Art Whitaker, a Piper distributor in Oregon. Three agricultural models have already been shipped abroad, with one each going to France, Morocco, and South Africa, and three are scheduled to go to Bogota, Colombia. About 20 more are on order.

Gear on the tandem model was also designed and is being supplied by Art Whitaker. Each landing gear strut carries two balloon tires mounted one ahead of the other. The front wheel has no brakes and is inflated to only four pounds, while the rear wheel carries eight pounds pressure.

The gear, which costs $265 extra, adds 40 lb., but effect on performance is said to be negligible. Owners of planes with standard wheels can buy the tandem-wheel setup through their local dealer and have it installed by him. Installation is simple and can be readily handled by any qualified mechanic. About 60 of the tandem-wheel 105 Super Cubs have already been distributed. Approval of the craft on Edo Model 1400 floats is expected soon.

► **Piper Prospects**—The company views 1950 with optimism and sees the possibility of production reaching 110 percent of last year (1278 planes shipped in 1949, including 203 Stinsons—AVIATION WEEK Feb. 27). If output of the Super Cub could be stepped up to 8-10 daily over a six-month period, it is believed that man-hours per plane could be reduced to 190-200.

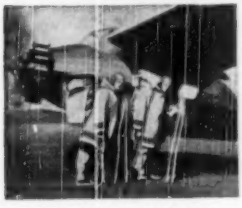


WRIGHT BROTHERS

ADMIRAL BYRD

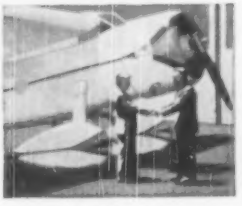
LINDBERGH

AMELIA EARHART



SIR HUBERT WILKINS

KINGSFORD SMITH



WILEY POST

JOE DE BONA

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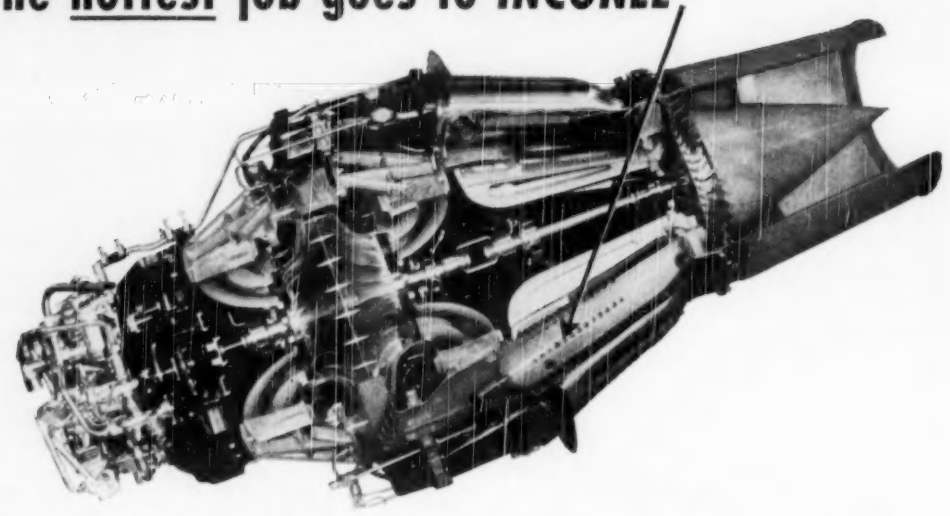

The J33 Turbo-Jet powers Lockheed's famous P-80 "Shooting Star." Inconel combustion chamber linings help extend engine life and reduce maintenance costs.

It takes a *tough* metal . . . an unusually corrosive-resistant and heat-resistant one . . . to survive the white-hot blast of burning jet fuels.

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Because of these "fight-back" qualities, Inconel has proved to be the answer to some of aviation's knottiest high-temperature problems . . . engine exhaust systems, heater combustion chambers, and fastenings, for example.

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FINANCIAL

How Past Taxes Affect Earnings

Peculiar nature of aircraft industry makes the annual reports of manufacturers only tentative at best.

There is no doubt about the impressive nature of aircraft earnings last year. Only in a few cases, however, are the results indicative of so-called "normal" earnings. In some instances, tax adjustments belonging to prior years are important factors in adding or curtailing earnings. Taxes which properly may belong to prior periods also remain as a contingent claim against earnings of subsequent years.

There are other adjustments which must be given serious attention to appraise earnings currently reported. The aircraft industry is essentially a contracting business and as such does not lend itself to an exact accounting by precise yearly periods.

Major procurement contracts may run upwards of two years before completion. Accordingly, any interim accounting determination must be regarded as only tentative until all contract deliveries are made. Actually, however, once the annual reports of most aircraft companies are released, the published figures are accepted as final and filed away in the reference manuals.

▶ **Settlement Delayed**—Even assuming that contract deliveries are all completed, there is no irrevocable finality to the transaction. With the government the principal customer, the aircraft industry is subject to a series of contract price redeterminations and renegotiations.

These processes may run their course a year or more before management will know the exact profit or loss adjustments that may apply to completed business of prior years. For example:

• **Douglas Aircraft Corp.** for the year ended Nov. 30, 1949, reported net income of $5,516,700 or $9.19 per share. However, a note to the financial statements call attention to the fact that the U.S. Treasury Department is now contesting certain tax matters for 1946 and 1947.

If all of the government contentions prevail, an additional tax liability of $6,600,000 plus interest would be imposed upon Douglas. The company does not agree with the government contention and has made no provision for such payment in its statements. (To do so would, in effect, tacitly admit the government claim). Douglas, in another action, is prosecuting a claim for approximately $3 million of excess profits tax relief for 1941.

• **Curtiss-Wright Corp.**, since the end of the war, has shown as a current liability a substantial amount representing provision for federal income taxes. As of Dec. 31, 1949, this item came to $15,267,844, down from the $18,151,430 shown a year earlier.

Here too, a financial note calls attention to the fact that 1944 to 1947 tax returns are in the process of examination by the Treasury Department. The management, however, believes that it is probable that a substantial portion of the amount provided in the balance sheet for this purpose will be restored to surplus when settlement of taxes for these years has been concluded.

In other words, results for 1944 to 1947 may have been understated in the light of this pending tax adjustment.

• **Lockheed Aircraft Corp.**'s earnings for 1949, as reported, amounted to $5,491,000 or $5.10 per share. However, during that year the company picked up in current earnings tax adjustments belonging to previous years. These amounted to $1,155,988 or $1.07 per share.

• **Consolidated Vultee** provides one of the more noteworthy examples as to what a difference accounting treatment can make in earnings. For the year ended Nov. 30, 1949, the company showed net earnings of $3,713,156 or $1.60 per share.

With the close of the 1949 fiscal year, Convair changed its accounting policy with respect to cost-plus-fixed-fee government contracts. Starting with the first quarter of fiscal 1950, the company will bill allowable costs and associated fees on a current basis, a practice followed by most aircraft units.

In the past, the company carried sales and fees to income only as the actual articles built were delivered. Under this procedure, a certain amount of profit and sales remained suspended between the time of actual accomplishment of the work and the final delivery of the articles manufactured.

Were this revised accounting system in effect during 1949, Convair's earnings last year would have been augmented by $2,200,000 (about 95 cents a share), approximately $400,000 of which would have been attributable to that year.

It is obvious that this $2,200,000 will now become part of 1950's earnings together with the current profits to be accumulated this year under the revised accounting system. In other words, it is likely that the final 1950 earnings for Convair will show a substantial improvement over 1949, but part of this result will be due to an accounting change.

• **Republic Aviation Corp.** reports a net income of $576,632 or about 87 cents a share for 1949. Included in current earnings as part of other income, however, is an item of $580,121 representing separation claims recovered as an allowable cost and which presumably could be attributed to activities in prior periods.

On this basis, it would appear that Republic's "normal" earnings, after tax adjustments, for 1949 were closer to $560,790 or about 56 cents per share.

• **Fairchild Engine & Airplane Corp.**'s annual report reveals perhaps the most astounding accounting "adjustment." For the year ended Dec. 31, 1948, the former management reported a net profit, after taxes, of $1,552,382.

An examination of the 1948 statements reveals no mention or note anywhere to give an inkling of what is now disclosed in the 1949 annual report. The Securities and Exchange Commission, it is now indicated, issued a deficiency letter concerning the 1948 annual report, in which an item of $500,000 was included in valuing inventories to reflect the probable recovery of general and administrative expenses in some future year.

The former management considered that such expenses were applicable to airplanes to be delivered in future years and would be taken into account in subsequent price redetermination proceedings. Also, the 1948 report by the former management, included as an inventory item $86,572 representing the cost of certain development work undertaken with a view to obtaining additional contracts.

The present Fairchild management asserts that it considered the treatment of these two items as departures from the accounting policies previously followed by the company and not warranted by existing circumstances. Accordingly, amended statements for 1948 were filed with the SEC in which these expenses were charged to income. This action resulted in a reduction after taxes of $340,819 in earnings for the year 1948.

—Selig Altschul

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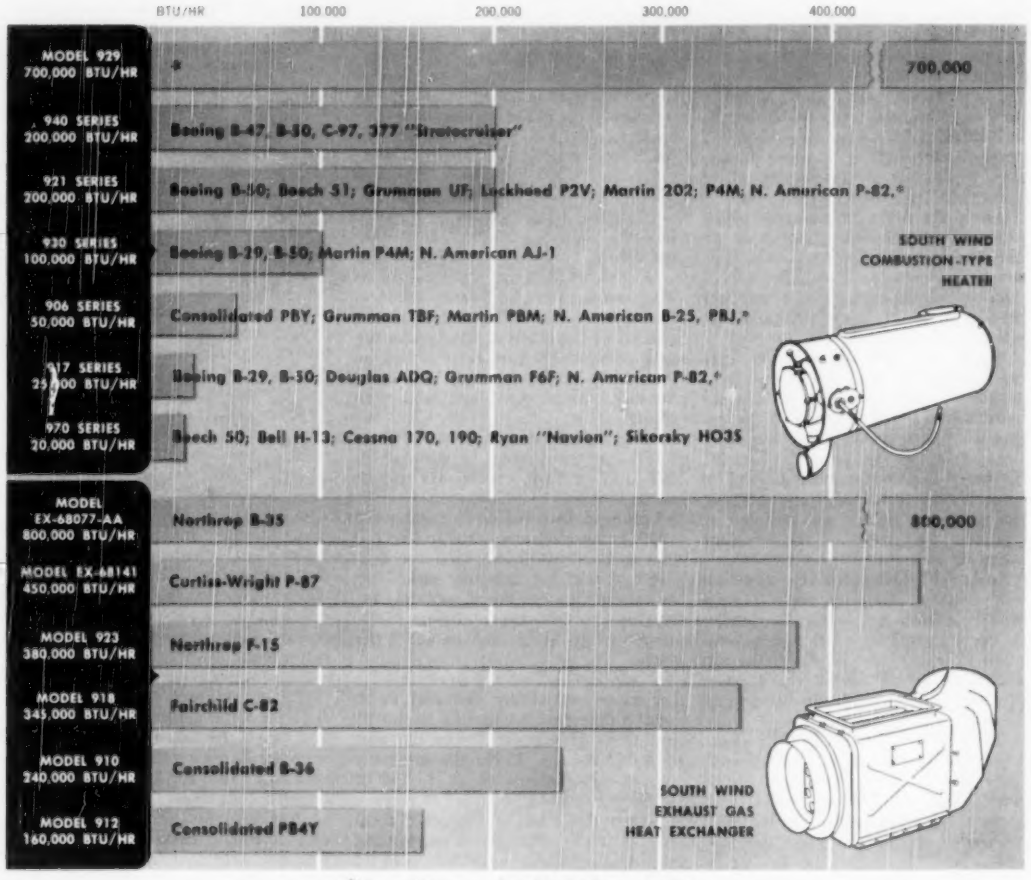

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STEWART WARNER

AIRCRAFT HEATING AND THERMAL ANTI-ICING EQUIPMENT

Power Study for Long-Range Transports

Analysis covers three propulsion schemes for high-speed travel.

By Alexander Kartveli*

In discussing the requisites of air transportation, it has always been my opinion that there is one basic parameter—speed. In addition to its practical importance, the factor of speed has a psychological value, and its influence on profit and cost cannot be evaluated by mathematical formulas.

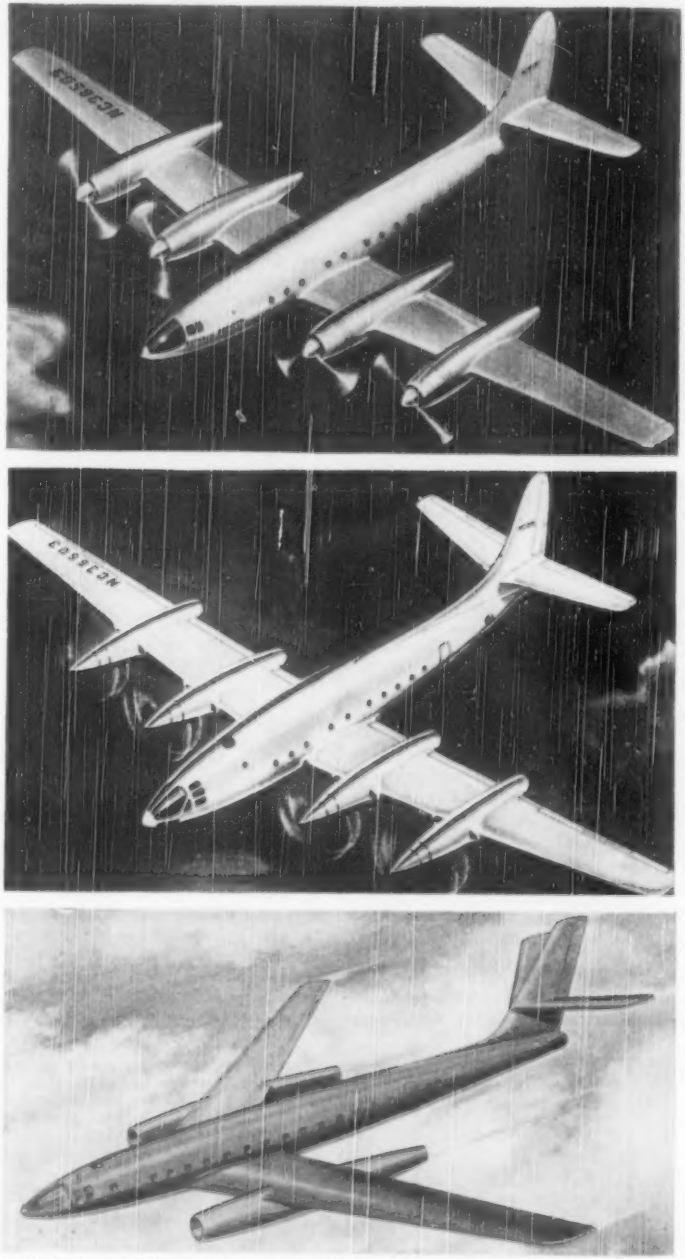
Importance of speed becomes much more pronounced in the case of long range transports where, in addition to psychological advantage, the saving of time is the most attractive feature. Therefore, we should exert all our efforts to the attainment of greater speeds within practical limits of safety and economy.

As we all know, the postwar era has brought into existence several new propulsion devices offering interesting prospects for increasing speed. How can these new propulsion devices at our disposal affect the performance of long range transport planes, and what improvements in speed at a given range can be obtained?

Three possible power plant versions are now made available for this type of aircraft: Reciprocating engine compounded with turbo-supercharger, turboprop, and pure jet. Each type has its advantages and defects, and each is now being considered by the aeronautical engineers.

▶ **Approach**—The problem of appraising the fitness of a power plant for a given type of airplane is very complex when treated in its generality. It not only involves factors depending upon the engine, but also those of the airplane and outside conditions.

Factors such as engine size and weight, specific fuel consumption, cooling, propeller efficiency, airplane weight and useful load, aerodynamic characteristics of the wing, compressibility, structural considerations of aeroelasticity, etc., should all be considered in their respective relation. Because of the multiplicity of factors, a general analytical study becomes so involved that



RAINBOW VERSIONS: piston engine (top), turboprop (center), turbojet (bottom).

* Vice president-chief engineer, Republic Aviation Corp. Paper delivered at the Fifth Annual Flight Propulsion Meeting of the Institute of the Aeronautical Sciences, Cleveland, Ohio, Mar. 24.

The Birdmen's Perch

"We're lost!" the Captain shouted.

Unless you're one of those eccentric buzz-boys who enjoy an emergency landing in somebody's pea patch, those words should scare the be-jeepers out of you.

It gets you right under the safety belt, as they say, and it ain't good. Yet, plenty of otherwise good flyers, who don't know their navigation from a hole in the ground, just plain go out and "get lost."

Take the average lightplane pilot who flies without radio help. He's a demon at following a four-lane highway on a clear day, but throw in some poor visibility and it's another story. And—even if he sports the latest in radio equipment, a fuse can blow his set deader than a herring.

There's only one answer—practice your navigation! Keep your technique "fresh" and there's no reason for you to ever get lost or miss your destination.

And Speaking of Destinations...

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Modestly enough, it's the world's finest detergent dispersant oil for horizontally opposed engines because—it's the only lightplane oil put through Gulf's exclusive Alchlor process to remove extra carbon and sludge formers!

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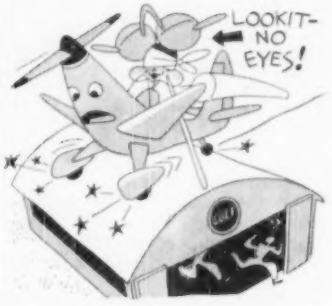
Little Known Facts Dept.

And now, students, if you can tear your eyes away from "Smiling Jack" for a

minute, the Dean has an important honor to confer. Will Mr. Leonard King of Adrian, Mich., step forward, please.

Mr. King, your Little Known Fact About Well Known Planes has been carefully scrutinized by the faculty and termed not only appropriate, but highly sensational. Therefore, with the powers invested in me by goodness knows who, I commission you as Perch Pilot (bottom rung)! If the student body will now rise, I shall read the Little Known Fact, submitted with PROOF!



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the conclusions reached are of academic and general character.

Analysis of the relative merits of various powerplants, therefore, should be conducted not from the academic, but from a purely engineering point of view in the light of the present state of the art, available methods and technique and equipment which exist, or which will exist in the near future.

▶ **Basis of Comparison**—In this analysis, we first considered a long-range transport plane equipped with four turbosupercharged reciprocating engines. We assumed this airplane to be designed in accordance with modern technique using the latest available equipment, and complying with all necessary requirements. For this airplane, curves of range versus cruising speed were computed at various altitudes. Studies were then made of how these curves would change if the reciprocating powerplant were replaced, first by a turboprop, and then by a pure jet powerplant.

To make this comparison valid, the payload, as well as the fuselage and its contents, were left the same in all cases. Certain small adjustments were made, however, in the thickness and area of the wing to bring its aerodynamic qualities in accordance with the speed attainable with a given powerplant. In making this adjustment, the volumetric capacity of the wing was kept the same in each case, so that the total volume of fuel carried remained unchanged. We believe that this basis of comparison is rational. For the sake of clarity, however, we would like to explain this point in more detail.

▶ **Wing Considerations**—In choosing the wing for a high-speed airplane, the thickness, aspect ratio, span and a certain magnitude of area are first assumed to comply with necessary structural, weight, flutter and compressibility requirements. A check is then made that such a wing meets auxiliary requirements of takeoff, climb, maneuverability, landing, etc., when used with a given powerplant.

It is usually found that with modern powerplants these requirements are not critical within the acceptable values of wing loading. This is because of the high horsepower at takeoff these powerplants develop due to water injection in the case of reciprocating engines, inherent large horsepower of turboprop engines, and the use of afterburning in the case of pure jet engines. These requirements, therefore, do not affect the value of wing area.

An analytical study of range versus cruising speed shows that for the achievement of greater cruising speed without much loss in range it is advantageous to keep the wing area rather small to reduce compressibility drag. It is, however, impossible to reduce the

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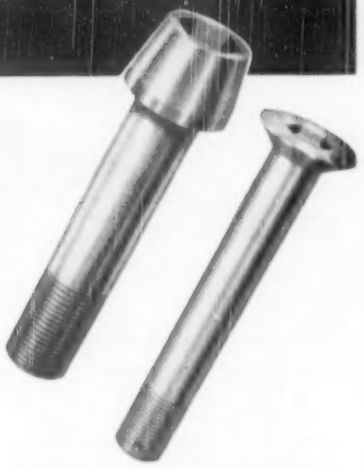

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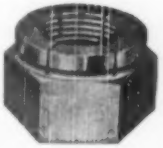

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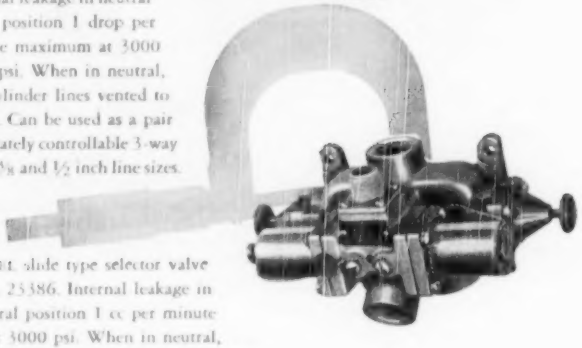
New ADEL poppet type selector valve No. 21700. Internal leakage in neutral position 1 drop per minute maximum at 3000 psi. When in neutral, cylinder lines vented to return. Can be used as a pair of separately controllable 3-way valves. ⅜ and ½ inch line sizes.



New ADEL slide type selector valve No. 25386. Internal leakage in neutral position 1 cc per minute at 3000 psi. When in neutral, cylinder lines can be blocked or vented to return. Variations available with centering springs or detents. ¼, ⅜ and ½ inch line sizes.

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- ★ No moving seals.
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- ★ Pressure drop 50 psi. at 6 gpm.; 100 psi. at 9 gpm.
- ★ Produced for 17-30 volts dc, 10 watts minimum; available for other dc voltages.
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wing area to the desirable lower limit because of the necessity of having a given minimum volumetric capacity for fuel.

Thus, the volumetric capacity becomes a very important factor in determining the final value of the wing area. It is logical, therefore, that in pursuing this analysis, wings with the same volumetric capacity should be considered in each case.

In this way three airplanes of approximately the same size, carrying the same payload, and having the same fuel capacity, were obtained. The gross weight of these craft varies within reasonable limits depending upon the conditions of each case. It is believed that the problem so treated will yield interesting practical results, and will correspond to the actual case which confronts the industry now.

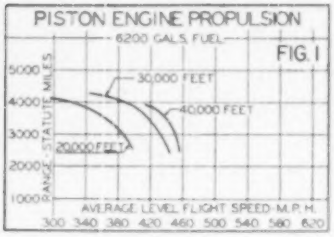
► **Rainbow**—As a basic airplane of this type, we have chosen the Republic Rainbow for which a large number of flight tests, wind tunnel and theoretical investigations are available.

This airplane is a long range transport carrying 40 passengers and 6 crew members, with a total payload of 10,000 lb. It has a mid-wing arrangement with a wing area of 1,640 sq. ft., aspect ratio of 10, and an average thickness of approximately 15¼ percent. The buffeting limit is approximately .76 Mach number. The wing has an available internal volume to carry 6200 gal. of gasoline. With 10,000 lb. of payload and 6200 gal. of fuel, the gross weight of the plane is 120,300 lb.

The reciprocating engine powerplant consists of four Pratt & Whitney R-4360 engines developing a takeoff horsepower of 3800 at sea level with water injection. Each engine is equipped with an exhaust-driven supercharger which permits high cruising powers to be carried to 40,000 ft. The turbosupercharger is so arranged in the nacelle that the exhaust gases are ejected horizontally through the aft end of the nacelle, thus providing a certain amount of jet thrust.

For this airplane, curves of range versus cruising speed at altitudes of 20,000, 30,000 and 40,000 ft. were computed. It was assumed in these computations that 10 min. at normal rated horsepower were spent on the ground for warm-up, taxiing, and takeoff.

It was further assumed that the climb to cruising altitude was performed under optimum conditions of minimum fuel burned and maximum distance gained in the climb, and that the reserve fuel allowance is 600 gal. The horizontal distance covered in the climb was added to the computed level flight range, but no increase in range was taken due to the horizontal dis-



tance covered in the descent.

Fig. 1 shows range versus speed curves at three altitudes for this reciprocating engine version.

At each altitude, the horsepower of the engines was varied between maximum permissible cruising horsepower at that altitude and the minimum cruising power corresponding to the best value of miles per pound. Where applicable, the lower limit of cruising power was taken equal to that power which gave a rate of climb of 200 fpm.

It is seen that the range-speed performance of this airplane improves considerably when the altitude increases. At 40,000 ft., a range of approximately 4000 mi. could be obtained at an average cruising speed of 400 mph., while a range of 2750 mi. could be flown at a speed of 450 mph. or a Mach number of .67, thus giving a margin below buffeting limit of .1 Mach, or 66 mph.

This airplane could, therefore, be used on trans-Atlantic runs between New York and London with an average cruising speed of 400 mph., and also on transcontinental New York to Los Angeles runs with a speed of 450 mph.

► **Rainbow with Turboprops**—We next studied the same airplane equipped with four Allison turboprop engines. The accompanying illustration shows the smaller nacelles attainable with this type of powerplant.

In this study, we again assumed that the fuselage and contents remained unchanged, that is to say, payload, passenger accommodations, and all the equipment and accessories necessary to operate and control the airplane are identical.

The wing, however, while basically identical to the preceding case, has a longer average chord which brings its average thickness to 14 percent or 1¼ percent thinner than that of the Rainbow. This change is accomplished by extending that portion of the leading edge which overhangs the front spar. Under this condition, the wing has an area of 1750 sq. ft., a slightly smaller aspect ratio, and the same available volumetric capacity of 6200 gals. Its critical buffeting limit for values of lift coefficient involved is increased from .76 to approximately .8.

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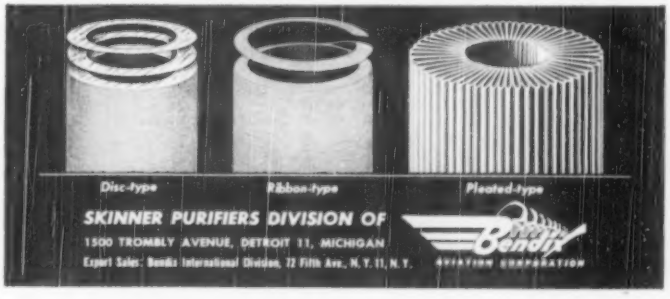

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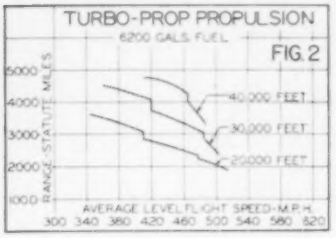


Each turboprop is installed in a nacelle of 40 in. maximum diameter. Distance between wing main spars is sufficiently large to permit the engines to be housed inside of the wing between these spars. Extension shafts protrude forward of the front spar and carry dual rotation propellers. Engine air is admitted through two openings in the leading edge, symmetrically located on either side of the nacelle.

Due to the lighter weight of the turboprop engine, and absence of cooling equipment, such as intercoolers, oil coolers, various air inlets and ducts, the total weight of the powerplant is considerably less than in the preceding case. A saving of 6600 lb. results from this interchange of powerplants. Since the fuel capacity of the wing is the same as before, 6200 gal. of kerosene could be used instead of gasoline, giving an increase of fuel load of 4960 lb.

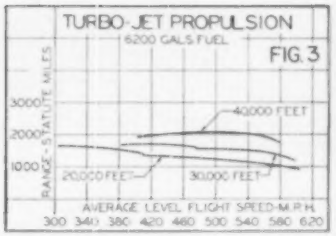
Allowing certain additional weight for wing reinforcement to take care of the longer leading edge and higher speed, the gross weight of the airplane becomes 119,400 lb.

Curves of range versus velocity were computed for this airplane under the same assumptions as before. Fig. 2 gives these curves for the same altitudes of 20,000, 30,000 and 40,000 ft.

In these computations, it was assumed that the rpm. of each engine varies between the value corresponding to full normal power and the value giving 60 percent of normal power. Since the specific fuel consumption increases rapidly below 60 percent of normal power, it was assumed that further reduction of power was accomplished by stopping one of the two siamesed engines in various nacelles. First two units, then four were assumed inactive. This explains the steps in the performance curves on Fig. 2. Numerical computations were based on re-rated values of power which will be available in the near future.

As can be seen, the range increases with altitude, while the maximum possible cruising speed is obtainable at lower altitude. A maximum range of 4750 mi. at 410 mph. can be obtained at 40,000 ft. At 20,000 ft. a cruising speed of 515 mph. will give a range of 1875 mi.

A transoceanic non-stop flight of 4000



mi. at 40,000 ft. will have an average cruising speed of 465 mph., while a transcontinental run of 2750 mi. will take place at approximately 500 mph. at 30,000 ft. In both cases, the margin below buffeting limit is approximately .1 Mach.

It is to be noted that propellers used in these computations are of existing types. It appears, therefore, that this combination does not involve the development of any new equipment.

► **Rainbow with Turbojets**—In the turbojet version of this airplane, the payload, fuselage and its contents remain the same. The airplane is, however, equipped with an entirely new wing. A sweptback wing having 35 deg. of sweep and a thickness of 12 percent was chosen. The wing has an area of 2000 sq. ft., aspect ratio of 8, and can house the same 6200 gals. of fuel. Its buffeting limit, within the values of lift coefficient considered, is estimated to be approximately .9 Mach.

A structural penalty of 6500 lb. was assumed as the additional cost of this wing, and added to the gross weight of the airplane. Under these conditions, with kerosene as fuel, the gross weight of the airplane is 126,150 lb.

The airplane is equipped with four recent-type turbojet engines located in two underslung nacelles. Each nacelle houses two engines, staggered one behind the other. Landing gear is also housed in the nacelles. Recent tests show that interference drag of an underslung nacelle can be considerably reduced if the boundary layer in the wing nacelle inboard intersection is bled away. The drag of this airplane was carefully computed, using recently available data.

Curves of range versus speed at various altitudes were established under the same conditions as before. Fig. 3 shows these curves. Again the range at a given speed increases with altitude, but the increase is of a much lesser amount than in the two preceding cases. A relatively constant range for wide variation of cruising speed is characteristic of jet propelled airplanes.

At 20,000 ft., a cruising speed of 580 mph. with a range of 1000 mi. could be obtained. At 40,000 ft. a range of 2000 mi. corresponds to a cruising speed of 550 mph. In both

Hartman 120-volt DC relays take the sting out of electrical problems in Northrop Scorpion

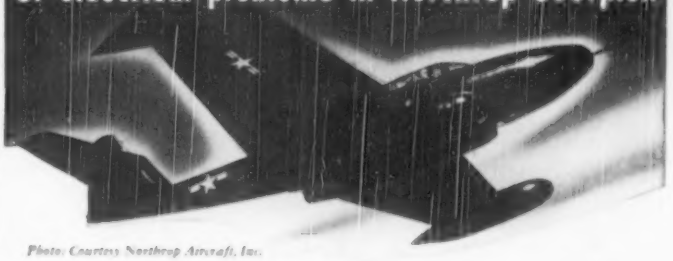


Photo: Courtesy Northrop Aircraft, Inc.

High-voltage electrical systems cut space and weight—all-important considerations in a high-performance aircraft such as the Northrop F-89 Scorpion. But, heretofore, problems in breaking large currents at the higher voltage have prevented use of the more efficient 120-volt DC system.

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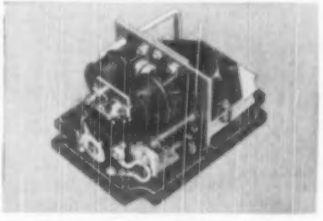
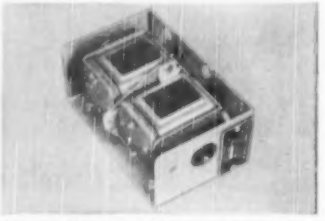
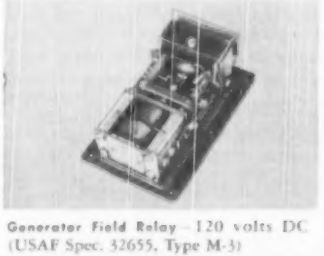


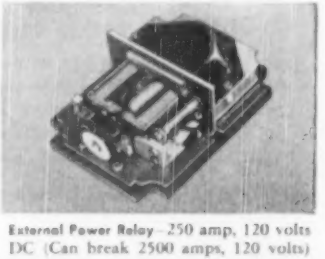
Reverse Current Cutout—250 amp, 120 volts DC (USAF Spec. 32649, Type Q-1)



Overvoltage Relay—120 volts DC (USAF Spec. 32652, Type E-3)



Generator Field Relay—120 volts DC (USAF Spec. 32655, Type M-3)



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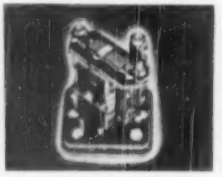

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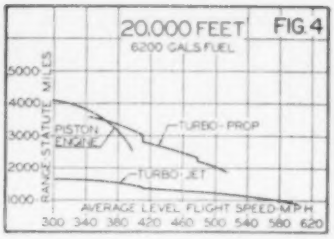
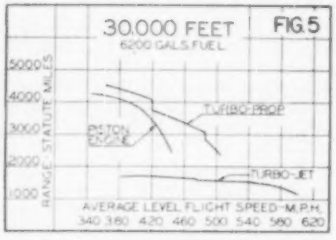
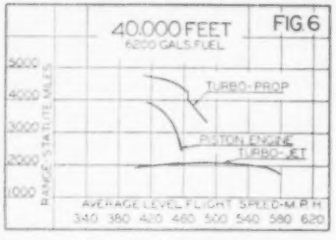






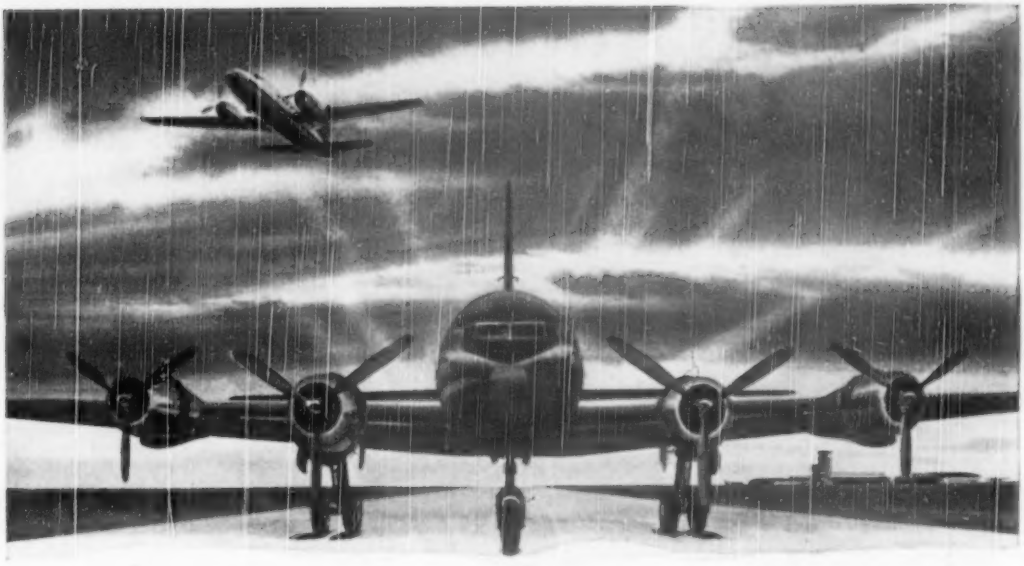
cases the margin below buffeting limit is approximately .1 Mach.

► **Comparisons**—We are now in possession of sets of curves for each airplane and are in a position to make a comparison. Fig. 4 shows range versus speed curves for the three combinations at 20,000 ft. For lower speeds, the reciprocating engine has a slightly greater range than the turboprop. At 365 mph., the range for both engines is equal, but beyond this speed the range of the reciprocating engine decreases rapidly and stays below that of the turboprop.

The curve for the turbojet is considerably below the two others. The maximum attainable speed for the turbojet, however, is some 90 mph. greater than that of the turboprop.

Fig. 5 gives similar curves for 30,000 ft. The turboprop curve is located entirely above that for the reciprocating engine, while the curve for the turbojet has shifted upwards slightly. For a range of 3000 miles, the cruising speed of the turboprop is some 50 mph. faster than that of the reciprocating engine. The maximum speed of the turbojet is approximately 90 mph. faster than that of the turboprop, but for a much lower range.

Fig. 6 shows the comparison at 40,000 ft. The curve for the turboprop has very definitely assumed the highest



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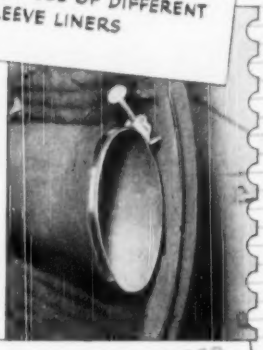

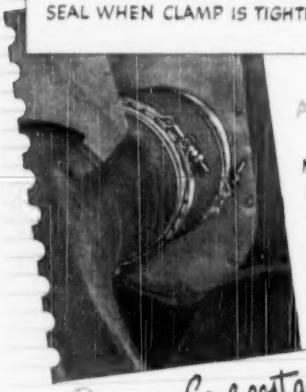

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position at all speeds within the capability of the engine. The reciprocating engine and the turboprop attain their maximum range at the same speed of 410 mph. At 450 mph., the range of the turboprop, however, is some 1500 mi. greater. For equal range, the cruising speed of the turboprop airplane is approximately 45 mph. greater than that of the reciprocating engine.

The curve for the turbojet has again taken a slight upward shift, and gives practically the same range of 2000 mi. for speeds from 420 to 570 mph.

It is to be remembered that only existing design propellers were considered in the cases of the turboprop and reciprocating engine. The use of supersonic propellers will undoubtedly extend the speed of the turboprop.

▶ **Conclusions Drawn**—This study was conducted on an unbiased basis with no preference to any of the three combinations. While lacking generality the results correspond to a modern, medium size transport airplane which brings it into the scope of the problem now confronting the industry. The final choice of the type of powerplant to be used could, of course, only be made after detailed study of the economics of each case, together with relative reliability and other service problems proper to each type of engine. From a purely engineering point of view, however, definite conclusions can be drawn.

As we strive for greater speeds coupled with long range, and in the presence of ever-increasing competition, it appears that the reciprocating engine no longer offers an adequate solution. Its range drops very rapidly after 400 mph. The choice is, therefore, between the turboprop and the pure jet.

The turboprop powerplant at altitudes from 30,000 to 40,000 ft. offers any range between 2500 and 4500 mi. at speeds of from 450 to 500 mph.

The pure jet at altitudes from 20,000 to 40,000 ft. covers the range between 1500 to 2000 mi. at 550 to 580 mph.

For non-stop transoceanic and transcontinental flights the turboprop is, therefore, the answer. For shorter runs of 2000 mi., or below, the pure jet gives considerably higher speed.

To obtain greater range with the pure jet an amount of fuel considerably in excess of that assumed would be necessary, which would automatically lead to a much larger airplane. Pure jets are, therefore, confined to high speed, relatively low range flight until such time as engines with much more efficient fuel consumption are available.

One more point appears evident from this analysis: Unless jet transports are flown at speeds of from 550 to 580 mph., their use is unjustified because for lower speeds approximately the same results could be obtained with the

turboprop with considerably less fuel expenditure. The aerodynamic design of the pure jet airplane must, therefore, be the most advanced, and it would be an error to build a jet-propelled transport airplane of conventional design with straight wings.

The sudden burst of air transport activities in England where turboprop and pure jet transports are about to be put into service, makes it necessary for our industry to face the challenge. If we are to keep our air supremacy over the seven seas, it is imperative that the industry start without any loss of time to develop turboprop transport planes for fast, long range service, and pure jet transports for shorter range at still higher speeds.

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- **Mixture control** will be a disk with small pyramids on the rim.

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The ball bearing is placed on a spindle in the inner bucket and rotated by a small electric motor, and a strain gage measures the tendency of the bearing's outer ring to move with the inner ring. If the test lubricant thickens from the cold, the inner ring does not turn freely, the gage registering a greater strain on the outer ring.

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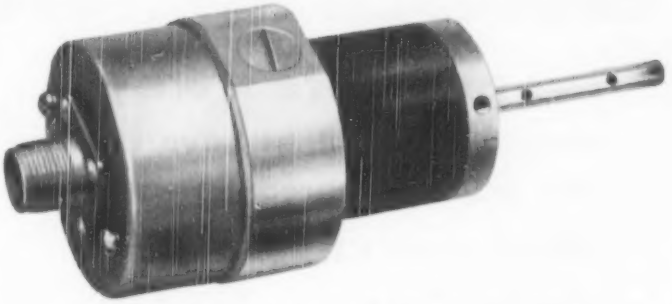
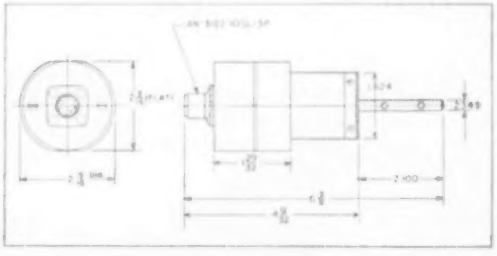
AN-M-10a and AN-M-40



Bendix now adds a new series to its already famous line of small D.C. motors. Designed to meet the latest government specification—ANM-40, these motors, with specially shielded brush boxes and equipped with radio noise filters tailor made for each specific type, are guaranteed to be noise free within specification limits over the range from .15 to 20 megacycles for conducted noise, and from .2 to 156 megacycles for radiated noise. These limits are maintained throughout the required ambient temperature range of −55°C. to +71°C. Light, compact, and highly efficient, these tiny motors are available in a wide variety of horsepower, speed and torque ratings. Send your detailed requirements to our Engineering Department. We will be glad to forward typical performance data and other engineering information.

When only the best is good enough, choose Bendix motors for:

- Actuator drives
- Recorder drive and take-up
- Servo mechanisms
- Fan and blower drives
- Band-change switching
- Stall-warning mechanisms



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these great airlines have chosen this most advanced transport to

Modernize Their Twin-Engine Fleets

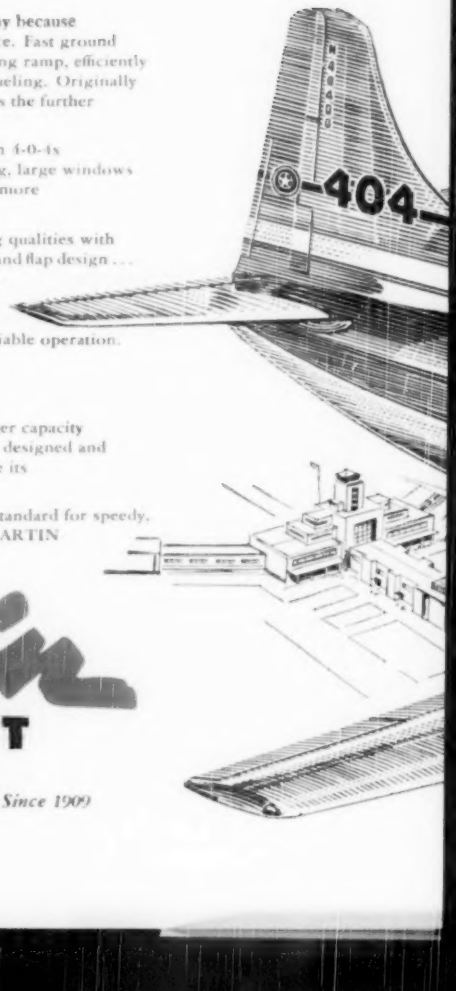
OPERATING ECONOMY! Martin 4-0-4 Airliners will offer maximum economy because of high revenue capacity, high cruising speed and low cost of maintenance. Fast ground loading will mean shorter stops because of such features as built-in loading ramp, efficiently arranged cargo compartments, fast taxi speed, high-speed underwing refueling. Originally designed for low-cost maintenance, the 4-0-4's basic configuration affords the further improvements developed through actual airline experience.

PASSENGER APPEAL! Pressurized, air-conditioned, comfortably quiet Martin 4-0-4s will put passengers in the lap of luxury. Spacious interior, modern styling, large windows and seats . . . *plus* shorter trip times . . . mean more appeal for travellers, more traffic for airlines.

DEPENDABILITY! Martin 4-0-4 Airliners will have excellent low-speed flying qualities with higher cruising speeds and consequent economy because of efficient wing and flap design . . . and yet the 4-0-4 can be operated into and out of smaller airports, aiding the expansion of air travel. Built-in aerodynamic stability permits wide range of loading passengers and cargo. Thermal anti-icing, tricycle landing gear, convenient pilot compartment . . . contribute to reliable operation.

DESIGN WITH A FUTURE! Present structural and performance margins of the Martin 4-0-4 will permit gross weight, payload and power plant changes to meet future airline requirements without altering the basic configuration. For air coach service, the 4-0-4's passenger capacity can be increased from 40 to 48 or 52 seats. And the Martin 4-0-4 will be designed and stressed for conversion to turbo-prop engines . . . to substantially increase its operating speed and extend its useful life by many years.

The Martin 4-0-4 is the twin-engine airliner with a future . . . the *new* standard for speedy, dependable, economical twin-engine fleet operation! THE GLENN L. MARTIN COMPANY, Baltimore 3, Maryland.



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pressurized, high-speed
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Properties of Tested Laminates

(77 F. and 50 Percent Relative Humidity[1])

Type of laminate	Density (g/cm³)	Ply arrangement	Impact strength[2] (ft.-lb./in. of notch)		Tensile modulus of elasticity (10^6 lb./in.²)	Tensile strength (10^3 lb./in.²)	Flexural strength (10^3 lb./in.²)	Compressive strength (10^3 lb./in.²)
			Flatwise	Edgewise				
Low-pressure cotton-fabric phenolic	1.34	Cross	6.0	3.2	1.0	12	18	22
Low-pressure Grade C phenolic	1.28	Cross	6.6	3.3	0.8	9	16	19
High-pressure Grade C phenolic[3]	1.36	Cross	5.7	2.8	1.0	10	18	20
Grade C phenolic	1.34	Parallel	5.1	2.7	.....	.....	21	25
Rayon-cotton-fabric phenolic	1.37	Cross	17.6	6.6	1.9	32	34	25
High-strength-paper phenolic	1.42	Cross	4.2	0.8	2.6	30	33	19
Grade AA asbestos-fabric phenolic	1.50	Parallel	4.6	3.8	1.5	8	16	20
Glass-fabric unsaturated polyester	1.82	Cross	31.5	9.9	3.0	43	53	42

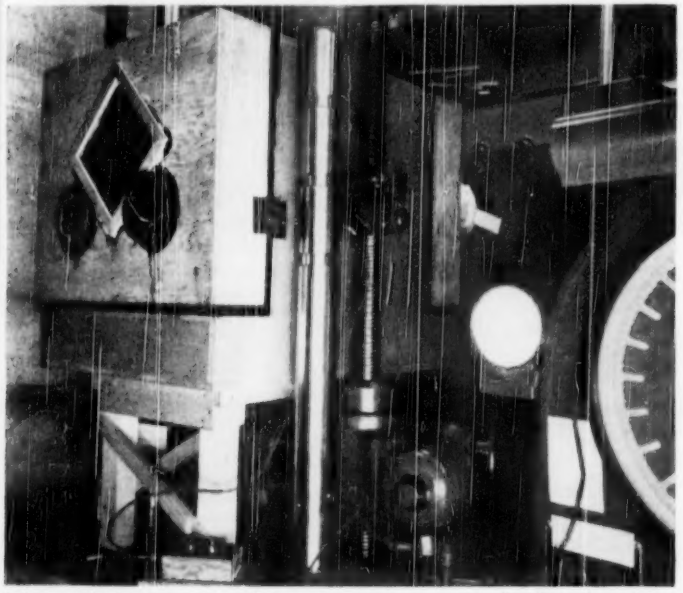
1. All strength values are for the lengthwise direction of the sheet.
2. The impact strength, flexural strength, and compressive strength measurements were made on 1/2-in.-thick material. The tensile tests were made on 1/8-in.-thick material.
3. Commercial sample.

Temperature Data on Laminated Plastics

Studies at National Bureau of Standards reveal how properties are affected in −70 to 200 F. range.

Light weight and high strength of laminated plastics have stepped up the use of these materials in aircraft applications—in floors, bulkheads, ducts, propellers, wing flaps, radomes and other components—but little or no information has been available on their mechanical properties at high and low temperatures.

To establish such data, the mechanical properties of 8 representatives laminated plastics were evaluated at the extreme temperatures of use, by J. J. Lamb, Isabelle Albrecht, and B. M. Axilrod of the National Bureau of Standards in a project sponsored by the National Advisory Committee for Aeronautics.



In low- and high-temperature tensile tests of laminated plastics, specimen, grips and strain gage were enclosed in temperature-controlled cabinet shown in place in hydraulic type testing machine. Window and armholes permit convenient handling of specimens and equipment. Selsyn motor links tensile strain gage and stress-strain recorder. A servicing unit supplys air of proper temperature for test enclosure.

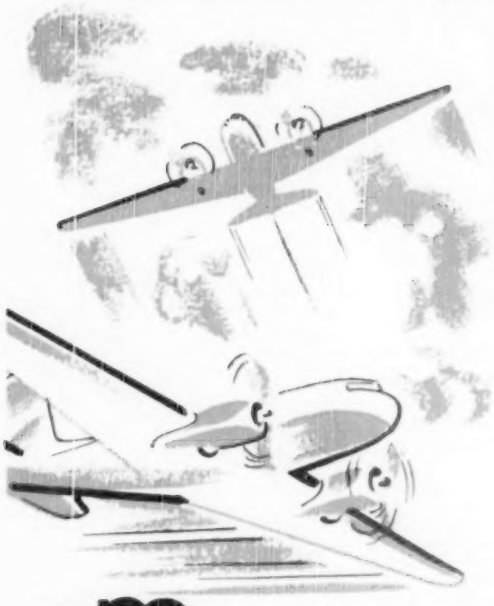
Izod impact strengths; flexural, tensile, and compressive strengths; and elastic moduli were measured at −70, 77, and 200 F. One of the laminates studied was made of a polyester resin with glass-fabric reinforcement, while the others were of phenolic resins reinforced with asbestos fabric, paper, cotton fabric, and rayon fabric.

This work was part of the Bureau's continuing program on properties of these materials, which has included effect of simulated service conditions and resistance to fuel immersion. Other projects now under way deal with resistance of glass-fabric laminates to high temperatures (up to 600 F.), effect of low-temperature storage on impact strength, and influence of production variables in the manufacture of glass-fabric laminates on the properties of the finished sheets.

► **Equipment Used**—Tests of mechanical properties were carried out in thermally insulated enclosures built specially for this purpose. And special jigs and fixtures also were required for flexural and compression tests.

For impact tests, a Baldwin-Southwark pendulum-type Izod impact machine was used. Flexural, tensile, and compressive tests used two Baldwin-Southwark hydraulic universal testing machines located in a room where atmosphere was controlled at 77 F. and

150,000 Marquette Wipers have been produced for military and civilian planes



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Douglas DC-4, C-54	Beechcraft C-45
Douglas C-74	North American B-25
Douglas C-124	Douglas B-26
Lockheed Constellation	Lockheed P-2 V-1
Lockheed Constitution	Martin JRM-1
Northrup Pioneer (C-123)	Consolidated PBY-5, 5A
Boeing C-97	Grumman JRF-1, G-21
Boeing B-50	Douglas C-117
Boeing B-29	Northrup RB-49
Fairchild C-82	Northrup B-35
Fairchild C-119 B	Northrup P-61

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50 percent relative humidity.

► **Tensile, Compressive Strengths**—The tensile strengths of the high-strength-paper, rayon-fabric, and glass-fabric laminates were found to be about three times those of the cotton-fabric and asbestos-fabric phenolics. In compressive strength the glass-fabric laminate was outstanding; at 77 F. its strength in the crosswise and lengthwise directions was 36,000 and 42,000 psi., respectively. Compressive strengths of the other laminates were about 21,000 psi.

It was found that the tensile and compressive strengths and moduli of elasticity of all the laminates increased at low temperature and decreased at high temperature.

Thus, for all laminates except the asbestos-fabric product, tensile and compressive strengths at 200 F. were approximately half of the corresponding values at —70 F. In the case of the asbestos-fabric product, the changes in the strength values were much smaller.

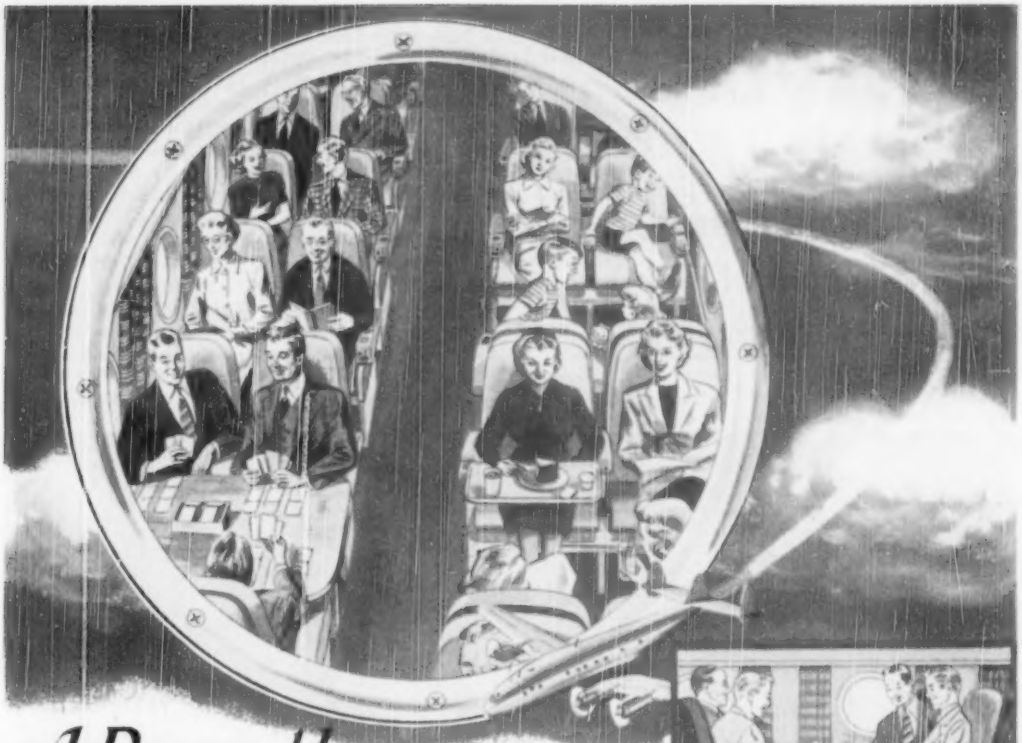
Decrease in the tensile and compressive moduli of the samples with temperature was much greater from —70 to 77 F. than from 77 to 200 F. Except for the high-strength-paper material, and overall changes were greater for the cellulose than for the mineral-type laminates. In general, the high-strength-paper, the asbestos-fabric, and glass-fabric products showed about the same variation of tensile and compressive moduli with temperature.

► **Impact Data**—The Izod impact strength values for the rayon-fabric and the glass-fabric laminates were much greater than for the other materials. It was also evident that the variation in impact strength with temperature was different for plastics having different types of reinforcement.

While the glass-fabric laminates decreased steadily in impact strength with increasing temperature, the cotton fabric laminates exhibited increasing impact strength with temperature, roughly doubling their strength values between —70 and 200 F. On the other hand, the asbestos-fabric, rayon-fabric, and high-strength-paper laminates showed little variation in impact strength between —70 and 200 F.

► **Flexure**—In flexural properties the high-strength-paper and glass-fabric laminates were superior, considering both flexural strength and flexural modulus of elasticity. An increase in flexural strength was noted for all the samples at low temperature; at high temperature a decrease occurred for all except the asbestos-fabric laminate, which showed no change.

The results of the Bureau's study indicate that the flexural properties of plastic laminates at high temperature are not a function of temperature only.



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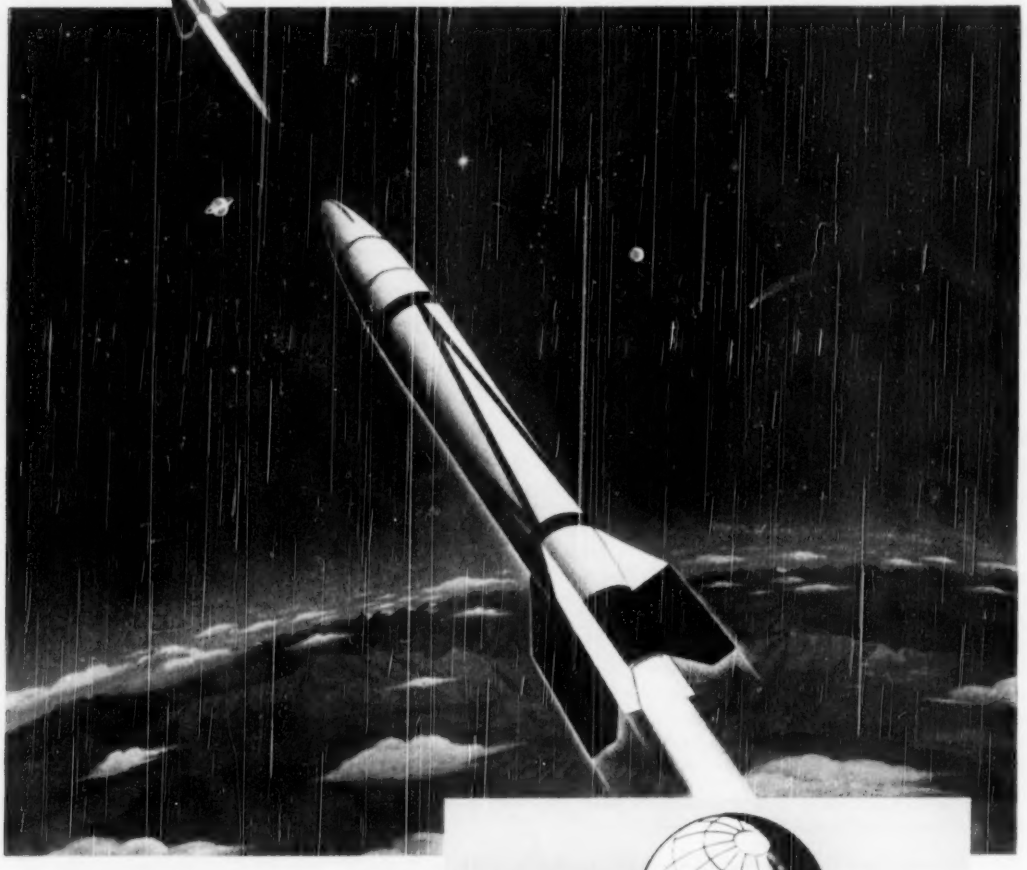
The "bumper" rocket used in this spectacular test was developed by Army Ordnance working with General Electric, California Institute of Technology Ballistics Research Laboratories, and Douglas Aircraft Company. Structural design of the "bumper" and construction of the "Wac" were among the contributions made by Douglas.

This is just one of the many missiles projects, so vital to America's defense, to which Douglas engineers have been devoting their skill and energies since 1941.

DOUGLAS AIRCRAFT COMPANY, INC., SANTA MONICA, CALIFORNIA



DEPEND ON DOUGLAS

30TH ANNIVERSARY YEAR

but may be affected by further cure of the resin and loss of moisture content.

It was also apparent that the effect of high humidity in addition to an elevated temperature may be quite different from the effect of temperature alone. Thus, a severe loss in strength was noted for the high-strength-paper and one low-pressure cotton-fabric laminate at 150 F. when the humidity was increased to 90 percent.

Copying Machine

Accuracy in fabrication of turbine blade manufacture is getting special emphasis at A. V. Roe Canada Ltd., Malton, Ontario, through use of a machine for reproduction of three dimensional surfaces to any scale. Designed by company technicians L. E. Marchant, V. W. Hall and J. O. Creek, the setup employs a master pattern larger than the article to be duplicated, and forging dies, reproduction masters and the like can be made by a reduction process so that the errors will be proportionally reduced to negligible size.

The machine consists of master table and a work table connected by a pantograph linkage governing the scale of reproduction. An overhead reduction lever carries a tracer wheel at its outer end and a ratio-related cutting medium, such as a grinding wheel, towards its fulcrum end.

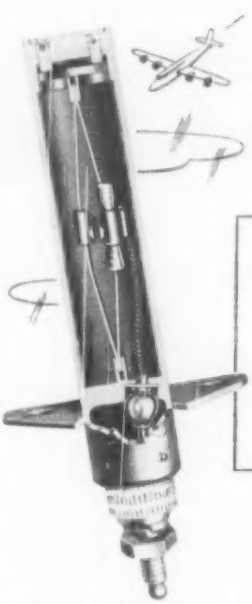
The master pattern, usually made of plaster, is caused to move in two planes so that the tracer wheel contacts the entire surface during its passage, while simultaneously the workpiece is being moved in a like manner, except that distance is in accord with the ratio prescribed by the pantograph. The third dimension, or rise and fall, is transmitted from the tracer wheel to the cutter or grinding wheel by the medium of the overhead lever.

The machine now in use has a reduction ratio of 10 to 1 and the finished workpiece embodies only one tenth the error in the plaster pattern which, because of its large size, can be made with considerable accuracy and finish.

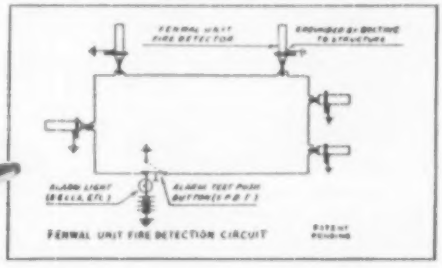
Sensitivity is a feature of the machine, the profile of a piece of "Scotch" tape on the surface of the plaster pattern being readily noticeable on the surface of the workpiece.

When completed, the workpiece is available as a master of accuracy for 1:1 quantity reproduction. Forging and coining dies, forging trim dies and punches, contour templates, and various other patterns in wood or metal may be produced. The machine can be adapted to produce enlarged copies of a master pattern where a proportional increase in the dimensional errors is of minor importance.

Why each month sees more airlines depending on Fenwal's positive fire detection



Employing unique THERMOSWITCH* thermostat, Fenwal Aircraft Fire Detection Systems provide fast, positive action and extreme accuracy over a long service life. That is why airline after airline has investigated and installed this constantly dependable protection — as a logical step toward maximum safety and efficiency in air transportation.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Exclusive single conductor loop circuit operates detectors even if circuit is accidentally broken. Even a double break only eliminates detectors located between breaks, other detectors remain independently operative . . . no averaging effects.

Cutaway view of Fenwal Fire Detector. 2-oz. hermetically sealed units comply well within CAA Technical Standard Order C-11 in accordance with Society of Automotive Engineers Specifications AS-401.

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Typical EEMCO solutions of difficult Actuator and Motor design problems

STABILIZER ACTUATOR, Linear Type

Magnetic clutch, radio noise suppressors. Normal load 2500 lbs. Maximum load, 8,000, static, 20,000 lbs. Stroke 7-1/2 in. Rate of travel, .62 inches per second. Weight, 17 lbs. Non-jamming end stops.

FLAP ACTUATOR, Linear Type

Magnetic clutch and brake, radio noise filter, internal non-jamming stops, auxiliary drive for manual operation. Normal load, 1800 lbs. Stroke, 5-1/2 inches. Rate of travel at normal load, .35 inches per sec. 28 volt d. c. Weight, 7-1/2 lbs.

EXPLOSION-PROOF HYDRAULIC PUMP DRIVE

Equipped with inline gear reduction. Gearbox designed to keep acoustic noise level at an absolute minimum. For continuous duty operation with duty cycle varying from 1-1/2 to 5 H.P. load. Designed to operate for 2000 hours without maintenance. Operates in a vertical position. Weight, 20-1/2 lbs.

ROTARY ACTUATOR PACKAGE

Magnetic clutch and brake and gear reduction, radio noise filter, adjustable travel limit switches. Explosion-proof motor. Entire unit totally enclosed in box equipped with mounting bracket. Output RPM at 5 inch-pounds load, 2500. Weight, complete, 3-1/4 lbs.

MOTOR FOR VALVE ACTUATOR

Weight, 11.7 ounces. 2-5/8" long by 1-5/8" by 1-13/16." 20 watts output at 18,000 RPM, intermittent duty. 28 volts d. c.

400 CYCLE BLOWER MOTOR

Capacitor type. Weight, 1 lb. 2-11/16" long, 2-5/8" dia. 10-1/2 watts output at 7500 RPM, continuous duty, 115 volts, single phase.

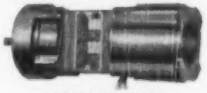
DOUBLE MOTOR POWER DRIVE

Small motor operates in conjunction with automatic pilot. Large motor used for manual control. Small motor—helical and worm gear reduction. Large motor—no reduction. *Outputs:* Small motor, 1/15 h.p. continuous; large motor, 5.5 h.p., 6 sec. duty cycle. *Output R.P.M.:* driven by small motor, 1000; driven by large motor, 10,000. Radio noise suppressors. 26 volts d.c. Weight, 16-1/2 lbs.

Performance Charts and Design Drawings for the above units, and many others, will be sent to executives and engineering and design personnel making request on company letterhead. These prints illustrate solutions of difficult design problems. They may suggest answers to similar problems of your own. Additional prints, for permanent reference file, supplied as released.

1/2 HORSEPOWER EXPLOSION-PROOF MOTOR

For use on a bomb hoist dolly. 24 volts d. c., 3,450 RPM, continuous duty. Weight, 17 lbs. Built to withstand exposure to the elements.



GUIDED MISSILE CONTROL MOTOR

3/4 H. P., 25,000 RPM, 10 minute duty cycle. Weight, 2.9 lbs. Silicone insulated. High temperature materials throughout. Temperature on outside of case at end of run, 250°C without damage to materials.

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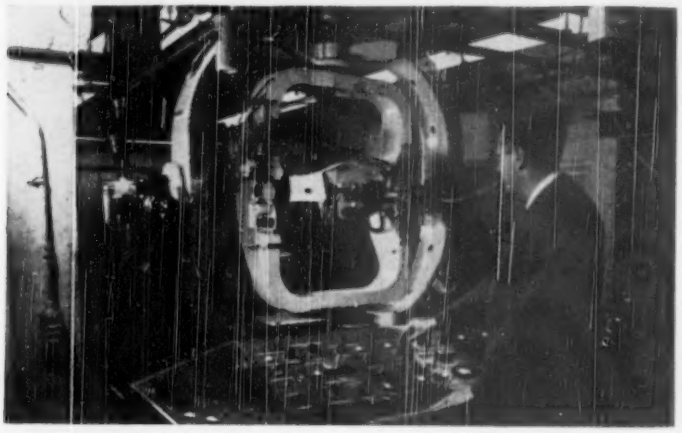


FLIGHT SIMULATOR's gimbal-frame, background, set up to contain characteristics of theoretical aircraft, responds to various commands transmitted from control board being operated by Dr. Albert C. Hall, of MIT's analysis and control lab.

Computer 'Flies' Aircraft Designs

An electronic-mechanical flight simulator has been developed to enable engineers to study flight characteristics and control systems of aircraft or missile designs prior to construction. It is stated that the device can save much of the cost and time involved in full-scale flight testing and also aid in improvement of the design.

The analogue computer, as it is technically known, was built in the Massachusetts Institute of Technology's dynamic analysis and control lab under the auspices of the Navy Bureau of Ordnance. The device is credited with already solving about 5000 intricate problems, each of which would have taken from 100-1000 hr. to work out manually using a desk calculator. One problem was handled in 20 sec.

▶ **Operation**—Required are characteristics obtained from working plans and wind tunnel test data of a model of the craft being studied. An "electrical model" of the design is then set up by positioning electronic computer dials to represent weight, velocity, altitude, wing span, etc.

The question is then fed into the simulator by applying appropriate electrical signals through a control board. The answer is recorded on a chart in a matter of seconds. It is stated that the problem can be computed in exactly the time it takes the control process to occur.

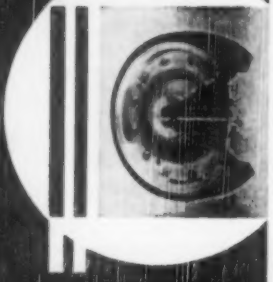
If the aircraft or missile's performance on the flight simulator is recorded as unsatisfactory, wing or tail designs, for instance, of the electrical model may be changed by simple adjustments of the computer dials until satisfactory behavior is noted. These changes may then be transferred to the plans before the actual craft is built.

▶ **Construction**—Used are rapid calculating machines and a "flight table" on which the actual problems relating to flight stability are worked out. The table consists of an arrangement of gimbals, delicately suspended to incline freely in any direction and supported on an independent foundation to obviate vibration.

The gimbal frame, operated by high-speed automatic controlling instruments which carry out motions in accordance with electrically transmitted commands from the control board, is used to orient the automatic control system of a plane or missile design exactly as it would be tested in actual flight. The gimbal frame table rolls, pitches and goes through all the motions the craft would make in the air under stated conditions. Its motions are recorded on a plotting board, but may also be studied visually.

▶ **Computer Designers**—Among MIT scientists contributing to the computer's development were: Dr. John F. Blackburn, automatic controls and supervision of mechanical design of gimbal frame; Emery St. George, Jr., instruments and electronics; Charles M. Edwards, electrical computer; and Thomas F. Jones, Jr., simulator operation. Dr. Albert C. Hall is director of the dynamic analysis and physics lab.

Darnell Casters



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- Increased Protection Against Metal-To-Metal Bottoming.
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Tiny Transformer

"The smallest standard audio transformer in the world" has been developed by the **United Transformer Co.**, 150 Varick St., New York 13, N. Y., according to that firm.

Designated type SSO, unit is said to be specially suitable for use in aircraft and particularly in Navy emergency miniature transmitters. Small enough to permit 30 to fit in a cigarette pack, it measures .4 x .75 x .56 in. Weight is .28 oz.

Firm says "great dependability is provided . . . through the use of a molded nylon bobbin and non-hygroscopic insulation throughout." Transformers are vacuum impregnated to permit operation under high humidity conditions. Five stock types cover input, interstage, output and reactor applications. Designs are available for all types of low level applications requiring wide frequency range.

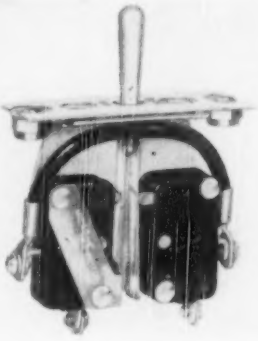
Small Fire Truck

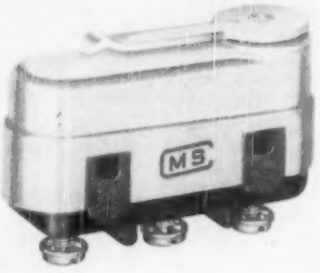
Low-cost Jeep fire truck carrying 340 lb. of dry chemical capable of extinguishing large-area liquid, gas, and electrical fires has been developed by **Ansul Chemical Co.**, Marinette, Wisc., in two models.

Model 340-J1 has one hose, coiled in steel cabinet, attached to chemical tank. Model 340-J2 has two hoses. Hoses may be operated singly or together.

There are two Ansul 20 extinguishers mounted on Jeep's hood. All fire equipment controls may be worked from the driver's seat, and the chemical tank can be pressurized en route to fire.

Up to four men can be carried. Truck's curb weight is given as 3200 lb., overall width 67 in., height 69 in., length 127 in. Wheelbase is 80 in., tread 48½ in., and minimum road clearance 8⅝ in.





For Switch Jobs

Designed for many uses in aircraft electrical systems, three-position momentary contact switch (top) No. 1AT1, offered by **Micro Switch**, Freeport, Illinois, is said to have special circuit arrangement not found in usual designs of momentary-contact double-throw switches.

Unit consists of metal bracket which mounts self-centering toggle and two V3-type switches. With toggle at center, one switch is normally closed and other normally open, with jumper wire connecting common terminal of two switches.

Operating toggle lever to right closes normally opened circuit of one switch, while throwing toggle to left opens normally closed circuit of the other switch. Entire unit weighs about 2 oz. Switch is rated at 10 amp., 125-250v. a.c.; 10 amp., 28v. d.c., non-inductive load; 6 amp., 28v. d.c., inductive rating.

Small, hermetically sealed snap-action switch (bottom) No. 1HS1, is designed for aircraft applications involving wide variance of temperature, extremes in air pressure, and hazardous atmospheres. Unit even may be operated under oil and other fluids.

Sealed case, or upper part of switch, is metal and filled with inert gas under

pressure. Case is secured to plastic base. And secured to base are six screw terminals, arranged to avoid strain on glass beads which seal conductors into metal case.

This switch is single-pole, double-throw type and is interchangeable with Micro Type Z "Pm" plunger basic switches, and can be used in all actuators and housings made for these plunger switches.

Current capacity, at any altitude at 28v. d.c., is 25 amp., resistive; 10 amp., inductive.

Other characteristics of unit are: operating force, 16 oz. p/m 6 oz.; release force, 4 oz., min.; movement differential, .020 in., max.; pretravel, .065 in., max., overtravel, .010 in., min.; contact break distance, .036 in., min. Switch dimensions are 1⅛ × ⅝ × 1⅜ in.

Tiny Chopper

Stated to have less than ½ volume of d.c.-a.c. choppers previously available, "Mini-chopper" is 1.3-oz. unit represented capable of carrying out all functions of modulation, de-modulation, rectification and inversion of intelligence signals normally accomplished by electronic or electro-mechanical choppers.

According to maker, **Servomechanisms, Inc.**, Mineola, N. Y. "there is no loss in efficiency" despite the "outstanding reduction in size and weight" of unit.

Incorporated in tube the size of lipstick container, chopper is designed for installation in standard 7-prong miniature electronic tube socket and for retention with standard miniature tube retainer. It is said to have life expectancy of over 1000 hr. and is claimed to be suitable for use in airborne equipment.

Section of Maintenance and Test Dept., National Aircraft Maintenance Corp., Hangar No. 8, Newark, N. J. Airport. Shown are: Test Machines for Fuel, Vacuum, and Hydraulic Pumps (1), Fuel Booster Pumps (2), Aircraft Generators (3), Aircraft Heaters (4). Other Test Machines not shown include: Hi-Lo Tension Magnetos, and Propeller Governors.

Photo Courtesy of National Aircraft Maintenance Corp.

MR. WILLIAM J. CUNNINGHAM
President
National Aircraft Maintenance Corp.

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AIR FORCE CONTRACTS

February Awards Top $70 Million

Curtiss-Wright highest contractor for month, and its B-36 propeller order is largest single contract.

Air Force contracts awarded in February totaled approximately 580, valued at about $73 million, the lowest figure in several months. Curtiss-Wright Corp. was top contractor, receiving orders aggregating $16,248,176.

CW-'s largest single contract, $11,-$16,559 for B-36 propellers, was also the largest single award during the month. A $3,770,541 order for Wright engines was the third largest single contract.

Boeing Airplane Co. was in second place for the month, with orders totaling $5,511,182. The order for the B-47C (AVIATION WEEK, Apr. 17), $4,-122,427, was the largest single February award made public.

Most of the Air Force contracts during the month, 438, were let on a fixed price basis. However, the greatest amount of money, $42,510,976, was involved in fixed price contracts with redetermination provisions. USAF is still negotiating the majority of its contracts, in February 371 calling for expenditure of $65,802,570. Contracts let after advertising totaled 190, valued at $7,026,992. Ten awards totaling $109,144 were made during February by Watson Laboratories and contracts let by Cambridge Laboratories numbered 20, valued at $229,836.

List of February contracts follows, with estimated completion dates indicated. Contracts for $100,000 or more are in addition to those published April 10.

$100,000 and Over

Beech Aircraft Corp., Wichita, spare parts for T-7, T-11 and C-45 aircraft, June, 1950, (two contracts) $1,160,205, $114,957.

Bell Aircraft Corp., Niagara Falls, N. Y., spare parts for H-13B aircraft, June, 1950, $371,541.

Bendix Products div., Bendix Aviation Corp., South Bend, Ind., control assemblies, May, 1951, $122,266.

Boeing Airplane Co., Seattle, Wash., spare parts for B-29 and B-50 aircraft, July, 1950, $346,979; spare parts for B-29, B-17G, B-50 and C-97 aircraft, July, 1950, $715,-129; training parts for ATC to be provisioned, Apr., 1950, $300,000; modification of one B-47B airplane and installation of four J-35-A-23 engines, June, 1951, $4,122,-427.

Canadian Commercial Corp., Montreal, spare parts for maintenance of C-47 and C-54-type aircraft, June, 1950, $264,900.

Cook Electric Co., Chicago, study of recovery systems for missiles and target aircraft, Mar., 1951, $306,000.

Cox-Stevens Aircraft Corp., Mineola, N. Y., electric aircraft weighing kit, July, 1950, $134,250.

Curtiss-Wright Propeller div., Curtiss-Wright Corp., Caldwell, N. J., installation and spare propeller assemblies, controls, blade assemblies and spare parts for B-36 airplanes, July, 1952, $11,016,559.

Douglas Aircraft Co., Santa Monica, spare parts for maintenance of C-47 and C-54-type aircraft, Feb., 1950, $397,349.

Eclipse-Pioneer div., Bendix Aviation Corp., Teterboro, N. J., spare parts for instruments, June, 1950, $125,000.

Fairchild Aircraft div., Fairchild Engine & Airplane Corp., Hagerstown, Md., spare parts for C-119-type aircraft, Nov., 1950, $1,485,000; spare parts for C-82 aircraft, June, 1950, $500,000; kits of parts required for compliance with Fairchild service bulletin, June, 1950, $186,618.

Gerity-Michigan Mfg. Co., Adrian, Mich., payment of state and local real property taxes on plancor 324, Adrian, Mich., Dec., 1950, $110,000.

Goodrich, B. F., Co. Akron, spare parts for wheels and brakes, Jan., 1951, $129,245; spare parts for B-25J aircraft, June, 1950, $232,400.

Hackensack Cable Corp., Hackensack, N. J., cable, Aug., 1950, $112,340.

Linde Air Products Co., New York, liquid oxygen and nitrogen and cascade oxygen and nitrogen, June, 1950, $140,174.

Minneapolis-Honeywell Regulator Co., Minneapolis, spare components for B-4 turbo regulator systems, Feb., 1951, $118,-618.

North American Aviation, Inc., Los Angeles, spare parts peculiar to T-6G, Feb., 1951, $360,000; increase in spare parts for B-45A aircraft, May, 1951, $100,000; 101 kits for B-45 airplanes and data, Feb., 1951, $141,275; spare parts for F-6, T-28, F-51, F-86, F-82, B-25 and B-45 aircraft, June, 1950, $271,600; spare parts for F-6 and T-51 aircraft, June, 1950, $1,572,000.

Remington Rand, Inc., Dayton, visible filing cabinets, Apr., 1950, $150,740.

Republic Aviation Corp., Farmingdale, N. Y., spare parts for F-84 aircraft, July, 1950, $254,088; spare parts for F-84 aircraft, July, 1950, $515,613; spare parts for F-84 and F-47 aircraft, July, 1950, $293,-290; spare parts for F-84 and F-47 aircraft, July, 1950, $382,300.

Sperry Gyroscope, div., Sperry Corp., Great Neck, N. Y., spare parts for instruments, June, 1950, $100,000.

Wright Aeronautical Corp., Curtiss-Wright Corp., Wood-Ridge, N. J., R-1300, R-1820-76B engines, spare parts and tools Nov., 1951, $3,770,541.

Less Than $100,000

AC Spark Plug div., General Motors Corp., Flint, Mich., revision pages for technical data, May, 1950, $1524.

Acadia Synthetic Products, Chicago, rubber sheet, May 1950, $18,759.

Acme Code Co., New York, publications, law books, Mar., 1950, $2553.

Acme Infra-Red Co., Detroit, infra-red oven and maintenance data, Mar., 1950, $6720.

Acme Litho Plate Graining, Brooklyn, N. Y., lithographic plates, Mar., 1950, $8905.

Adams Mfg. Eng. Co., Huntington Park, Calif., pliers, Mar., 1950, $3900.

Adamson United Co., Akron, additional work in connection with installation of brake and wheel roll test machine, July, 1950, $26,227.

Aero Service Corp., Philadelphia, maps, Ft. Worth and Birmingham areas, Apr., 1950, $7502.

Aero Supply Mfg. Co., Corry, Pa., aircraft bolts, May, 1950, $6761.

Aerotec Corp., Greenwich, Conn., maintenance data, May, 1950, $3518.

Aroquip Corp., Jackson, Mich., aircraft hose, Mar., 1950, $7500.

Air Associates, Inc., Teterboro, N. J., Tinnerman speed nuts, May, 1950, $2136.

Air Maze Corp., Cleveland, oil filters, Aug., 1950, $2723.

Air Products, Inc., Allentown, Pa., modification of one A-1 oxygen generator, Apr., 1950, $2490.

Air Reduction Sales Co., New York, kit—portable inert arc welding kit, type AH-1, June, 1950, $22,050; breathing oxygen, June, 1950, $3120.

Aircooled Motors, Inc., Syracuse, N. Y., emergency spare parts for O-335-3 engines used in H-13 aircraft, June, 1950, $1000; emergency spare parts for O-425-9 engine installed in L-13 aircraft, June, 1950, $10,-000; O-425-1 engines for the YH-18 aircraft, June, 1950, $94,309.

Aircraft Fittings Co., Cleveland, elbow, May, 1950, $2979; hose elbows and unions, May, 1950, $2040.

Aircraft Products Co., Clifton Heights, Pa., aircraft bolts, May, 1950, $1225.

AiResearch Mfg. Co., Los Angeles, heater assembly, May, 1950, $1478.

Airquipment Co., Burbank, Calif., type B-1 aircraft maintenance stands, July, 1950, $54,747.

All-American Airways, Inc., Wilmington, Del., modification of government-furnished glider pick-up unit, Apr., 1950, $4327.

Allied Business Comm., Los Angeles, services of technical representatives, Aug., 1950, $16,640.

Allison div., General Motors Corp., Indianapolis, services of overseas technical representatives, Oct., 1950, $84,400.

American Auto Typewriter Co., Chicago, mock-up and demonstrator trainer, July, 1950, $2300.

American Blower Corp., Dayton, 25 each radar set blower, Apr., 1950, $1888.

American Blower Corp., Detroit, electric blowers, June, 1950, $6991.

American Bosch Corp., Springfield, Mass., maintenance and overhaul spare parts and/or subassemblies for magnetos on R-3350 engines, July, 1950, $2298.

American Chain div., American Chain-Cable Co., York, Pa., cotter pins, May, 1950, $5570.

American Chronoscope Corp., Mt. Vernon, N. Y., study of required instrumentation for test and maintenance of aerial and ground photographic, May, 1950, $16,000.

American Flex Couplings Co., Erie, Pa., aircraft accessory power transmission shaft, Dec., 1950, $10,128.

American Gas Accumulator Co., Elizabeth, N. J., 60 each, time delay relay, Apr., 1950, $1575.

American Hair and Felt Co., Chicago, felt, Sept., 1950, $43,420.

American Machine Foundry Co., Brooklyn, N. Y., assemblies for AN TPS-10 antenna, July, 1950, $27,620.

American Phenolic Corp., Chicago, receptacles, Feb., 1950, $2667.

Anderson-Bolds, Inc., Cleveland, electric oil tempering furnace, May, 1950, $1590.

Ansco div., General Aniline Film Corp., Binghamton, N. Y., photographic film, Apr., 1950, $3450.

Arbeka Webbing Co., Pawtucket, R. I., parachute webbing, July, 1950, $4160.

Armour Research Foundation, Chicago, research on the physical and electrical properties of fuel samples, Aug., 1950, $2442.

Aro Equipment Corp., Bryan, Ohio, anti-G valves, Dec., 1950, $4990.

Associate Aircraft Tool Mfg. Co., Hamilton, Ohio, oil free air pump, Jan., 1951, $39,-657.

Associated Co., Wichita, aircraft clips, May, 1950, $20,216.

Associated Engineers, Inc., Ft. Wayne, Ind., design and manufacture of one lofting machine, Mar., 1951, $19,321.

Auto-Lite Battery Corp., Toledo, aircraft storage battery, 24v., 34 amp., dry, charged, Mar., 1950, $77,243.

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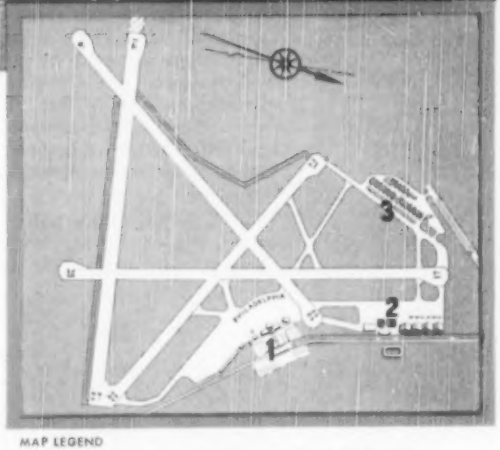

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MODERN EQUIPMENT MEANS SPEEDY SERVICE at this Wings, Inc. refueling pit. Here Wings, Inc. President Guy Miller (center), discusses aircraft maintenance with Operations Manager Joe Trapuzzano while a Beechcraft is being serviced for take-off by line boy James Duffy.

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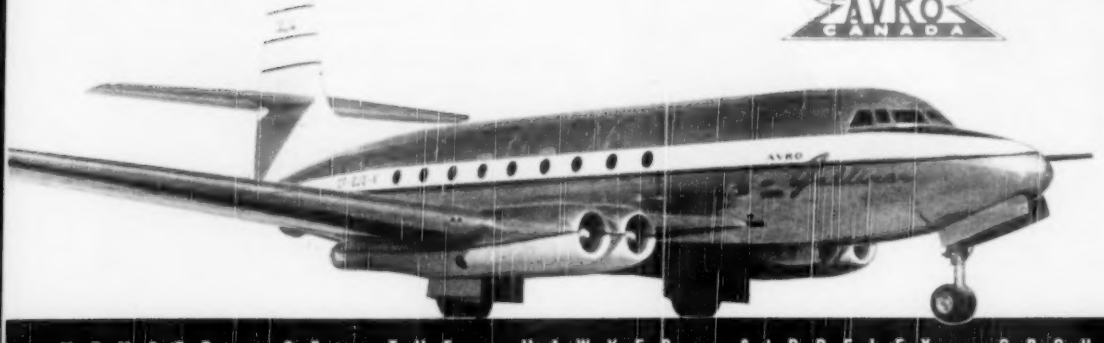

MEMBER OF THE HAWKER SIDDELEY GROUP

Axelson Mfg. Co., Los Angeles, design study of, and 3 each, constant speed drive transmissions, Feb., 1951, $59,950.

Barber-Colman Co., Rockford, Ill., motor and valve assembly, Apr., 1950, $4000.

Beaumont-Crandall, Inc., Kansas City, Mo., aircraft covers, June, 1950, $6842.

Beech Aircraft Corp., Wichita, C-45, T-7 and T-11 aircraft spares, June, 1950, $26,-919.

Belknap Hardware Mfg. Co., Louisville, battery clip, 20, 25, 50, 100, 200, 300, amp., insulated, negative clip Apr., 1950, $14,-953.

Bell and Howell Co., Chicago, photographic magazines, Mar., 1950, $8188; miscellaneous photo equipment, June, 1950, $41,954.

Bell Aircraft Corp., Buffalo, N. Y., conversion kits of parts for 200 hp. engine conversion, Apr., 1950, $17,336.

Bell Aircraft Corp., Niagara Falls, N. Y., spare parts for YH-12 and H-13 aircraft, June, 1950, $2077.

Boeing Airplane Co., Seattle, Wash., 30-day extension and an additional 150 hr. accelerated flight test program on B-50D airplane, Mar., 1950, $49,920.

Bendix Aviation Corp., Pacific div., N. Hollywood, Calif., technical data, May, 1950, $10,929.

Bendix Products div., Bendix Aviation Corp., South Bend, Ind., emergency procurement of fuel injection and carburetor spare parts, June, 1950, $75,000; replacement parts for wheels and brakes and wheel and brake assemblies, July, 1950, $64,903; development and test of a new-type shock absorber incorporated with a 36 x 7.7 size wheel, Dec., 1950, $99,000; technician services, June, 1950, $86,765; temperature drop tests with spin-up of an F-84 main landing gear strut, July, 1950, $27,300.

Bendix Radio div., Bendix Aviation Corp., Towson, Md., factory familiarization training, Mar., 1950, $2476.

Berkeley Scientific Co., Richmond, Calif., meter timer, interval and decoder, Sept., 1950, $28,145.

Blackhawk Mfg. Co., Milwaukee, Wisc., spare parts for hydraulic jacks, Oct., 1950, $3183.

Boeing Airplane Co., Seattle, Wash., spare parts for YC-97 aircraft, July, 1950, $28,-000; kits for portable air pump assemblies fabricated in accordance with AMC sketch SKE-5-1480 for AEC for special weapons testing, May, 1950, $13,326; special instrumentation of B-50D airplane 49-264 for SAC for special flight testing, Mar., 1950, $13,257; flight tests and study to determine means of reducing aileron control forces on B-50 airplanes, Feb., 1950, $22,144.

Boice-Crane Co., Toledo, saw band metal cutting, Mar., 1950, $3663.

Bone Engineering Corp., Glendale, Calif., bench, portable, electrical aircraft instrument repair, Sept., 1950, $6622; antenna assembly, June, 1950, $77,720.

Booz, Allen and Hamilton, Chicago, time-phasing study on production program for manufacture of guided missiles, July, 1950, $10,000.

Barden Corp., Danbury, Conn., ball bearing shaft, May, 1950, $10,650.

Breeze Corp., Newark, N. J., actuator assembly, July, 1950, $17,174.

Brilhart, Arnold, Ltd., Mineola, N. Y., plastic wedges, Mar., 1950, $3575.

Bubl Optical Co., Pittsburgh, lens assembly, June, 1950, $7672.

Bureau of Federal Supply, Cleveland, storage cabinets, Apr., 1950, $2645; desks, May, 1950, $69,225; storage cabinets, Apr., 1950, $8724.

Burke and James, Inc., Chicago, developing and processing tanks, Apr., 1950, $5144.

Burlington Mills, Burlington, Wisc., felt, May, 1950, $11,129.

Burlington Mills Corp., Greensboro, N. C., parachute webbing, June, 1950, $13,065.

Burton Mfg. Co., Los Angeles, recognition light, June, 1950, $8702.

Buser, R. G., Silk Corp., Paterson, N. J., nylon reinforcing tape, June, 1950, $62.2.

Camloc Fastener Corp., New York, fasteners, June, 1950, $5652.

Candace, Inc., Chicago, galvanized steel sheet, June, 1950, $15,961; low carbon low alloy sheets, July, 1950, $91,936.

Carborundum Co., Niagara Falls, N. Y., abrasives, May, 1950, $64,015.

Carnegie Institute of Technology, Pittsburgh metallurgical research, Dec., 1950, $40,000; research on the relativity of movement and rhythm, May, 1951, $9258.

Castle, Kenneth, Urbana, Ohio, push rod tool, housing, installing and aligning, Mar., 1950, $1160.

Celanese Corp. of America, New York, plastic sheet, May, 1950, $5389.

Century Ribbon Mills, Inc., New York, reinforcing tape, May, 1950, $1782.

Champion Spark Plug Co., Toledo, maintenance and overhaul spare parts for ignition equipment, June, 1950, $1235.

Chandler-Evans div., Niles-Bement-Pond Co., Hartford, Conn., valves and bearings, June, 1950, $1170.

Chase Chemical Co., Newark, N. J., photographic chemicals, Apr., 1950, $2660.

Chicago Aerial Survey Co., Chicago, photographic kits, May, 1950, $12,362.

Chicago Cardboard Co., Chicago, photographic mounts, Mar., 1950, $1722.

Clark Metal Products, Inc., Fairfield, Conn., plug engine cylinder dehydrater, Feb., 1950, $15,912; dehydrator plugs, May, 1950, $43,538; dehydrator plugs, May, 1950, $51,660.

Collins Radio Co., Cedar Rapids, remote tuning assembly for radio compass, Aug., 1950, $46,018.

Consolidated Engrg. Corp., Pasadena, Calif., repair and modernize one recording oscillograph and repair and modernize 14 galvanometers, July, 1950, $5680.

Consolidated Vultee Aircraft, San Diego, 165 additional combustors, Mar., 1950, $7053.

Continental Aviation and Engrg. Corp., Detroit, engineering services and technical assistance for testing jet engines used in model XQ-4 target missile, June, 1950, $2000.

Continental Motors Corp., Muskegon, Mich., spare parts for 0-136-1, 0-205-1 and 0-470-7 engines installed in L-16A, L-16B and L-17 aircraft, June, 1950, $26,500.

Congan Co., N. Hollywood, Calif., filter assembly, June, 1950, $1140.

Cook Electric Co., Chicago, pressure warning switch assembly, setting switch assembly, pressure emergency fuel, July, 1950, $12,895.

Cooper Precision Prod., Los Angeles, aircraft bolts, May, 1950, $1272; aircraft bolt, Apr., 1950, $1194.

Cornell Aeronautical Lab., Buffalo, investigation of rain erosion resistance properties of plastic materials, July, 1951, $29,902; research on lateral stability and control in stalled flight, Feb., 1951, $85,177; engineering services in the problem of static pressure research, Feb., 1951, $75,737; instrumentation of P-80 aircraft, Dec., 1950, $77,759.

Crocker Mfg. Co., Los Angeles, aircraft pins, May, 1950, $1051.

Curtiss-Wright Propeller div., Curtiss-Wright Corp., Caldwell, N. J., propeller control parts for B-50D series airplanes, Aug., 1950, $15,944; propeller assembly for B-36D, one spinner assembly and one complete set of propeller controls, Mar., 1950, $16,795; adaption of model C7468-B propeller to T-31 power plant, Aug., 1950, $23,977.

Danis, B. G., Co., Dayton, labor and materials to perform various maintenance services for engineering division, May, 1950, $10,000.

Davison Chemical Corp., Baltimore, dehydrating agent, Feb., 1950, $1988.

Dayton Aircraft Products, Inc., Dayton, type B-4 hydraulic aircraft jacks, Oct., 1950, $81,236.

Dayton Supply Tool Co., Dayton, bench-work laminated hardwood and metal top, Aug., 1950, $86,175.

Delco Products, div., General Motors Corp., Dayton, motor assembly, June, 1950, $2710.

Detroit Co., Los Angeles, nuts, June, 1950, $17,156.

Design Fabricators, Inc., Dayton, mock-up and demonstrator trainers, May, 1950, $1856.

Detrex Corp., Detroit, spray booth floor, Mar., 1950, $2145.

Detroit Diesel Engine div., General Motors Corp., Detroit, Mich., generator, Mar., 1950, $24,938.

Deutsch Co., Los Angeles, pipe fittings, May, 1950, $5915.

Doall Cincinnati Co., Cincinnati, furnace aluminum gas melting furnace, brass gas melting, Apr., 1950, $3567.

Douglas Aircraft Co., Santa Monica, Calif., iconolog tabulator, May, 1950, $18,-720; spare parts for maintenance of B-26 aircraft for Air National Guard, Mar., 1950, $25,000; spare parts for maintenance of Air Force Reserve B-26 aircraft, Feb., 1950, $2300; spare parts for maintenance of Air Force Reserve C-47 aircraft, Feb., 1950, $45,000.

Dynamic Air Engrg., Los Angeles, fan assembly, Mar., 1950, $4991.

Dzus Fastener Co., Babylon, N. Y., cowling fastener, May, 1950, $2624; fasteners, Mar., 1950, $1752.

Eastman Kodak Co., Rochester, N. Y., photographic paper (General Expense Marine), Apr., 1950, $9272; photographic film (Aviation Navy), May, 1950, $8442; photographic chemicals, Apr., 1950, $20,954; print straighteners, Sept., 1950, $6749; photographic film paper and plates (General Expense), Mar., 1950, $1193; photographic paper and film (Aviation Navy, Maint. Bur. of Ships, Research Navy), Mar., 1950, $3972; miscellaneous photographic equipment, Apr., 1950, $1578; photographic film (Aviation Navy), Mar., 1950, $2671.

Eastman, Samuel Co., Inc., Concord, N. H., spare parts for maintenance of crash fire trucks, Sept., 1950, $10,188.

Eclipse-Pioneer div., Bendix Aviation Corp., Teterboro, N. J., indicators, position and humidity, June, 1950, $7225; voltage regulators, July, 1950, $42,414; pressure indicators and transmitters, Aug., 1950, $46,-267; oil pressure transmitters, July, 1951, $85,500; generators, Eclipse 8 KVA model 1634-3 voltage electronic regulators, Sept., 1950, $10,000; pressure transmitters, Oct., 1950, $47,645; pressure indicators, May, 1951, $51,712; landing gear position indicator type C-1, June, 1951, $51,252; extractor driver wrench spacer compressor, etc., Aug., 1950, $3807; indicators and transmitters, Nov., 1950, $2240.

Elastic Stop Nut Corp of America, Union, N. J., aircraft nuts, Apr., 1950, $1916; aircraft nuts, May, 1950, $1842.

Electric Auto-Lite Co., Toledo, lamp-6V and 12V sealed unit service stop KD lamp, Apr., 1950, $2829.

Electrical Engrg.-Mfg. Co., Los Angeles, technical data, May, 1950, $1051.

Electro Impulse Laboratory, Eatontown, N. J., standing wave indicator, Apr., 1950, $17,460.

Electro Tec Corp., Little Ferry, N. J., gaskets, engineering reports and engineering data, Feb., 1951, $5360.

Electronic Associates, Inc., Long Branch, N. J., plotting board model, June, 1950, $21,915.

Elton, Inc., Jackson, Mich., maintenance communication spare parts, Mar., 1950, $1270.

Elwood Pattern Works, Indianapolis, printer assemblies, Apr., 1950, $43,720; miscellaneous photographic equipment, Apr., 1950, $2989.

Engelhard, Charles, Inc., East Newark, N. J., temperature bulb, Aug., 1950, $5121.

Fafnir Bearing Co., New Britain, Conn., bearings, Mar., 1950, $1092.

Fairchild Aircraft div., Fairchild Engine and Airplane Corp., Hagerstown, Md., spare parts for C-82 aircraft, June, 1950, $4900.

Fairchild Camera Instrument, Jamaica, N. Y., miscellaneous photographic equipment, Jan., 1951, $17,871; filter assembly and lens assembly, Sept., 1950, $8865; 140 each indicator subassemblies, July, 1950, $10,585.

Firestone Tire Rubber Co., Akron, aircraft casings, Feb., 1951, $44,406.

Fogarty Electric Co., Cincinnati, additional work in connection with installation of electrical facilities, building No. 28, Apr., 1950, $9780; installation of electrical equipment, Sept., 1950, $37,858.

Fordham University, New York, research on rigid type insulators, Aug., 1951, $14,078.

Frank and Warren, Brooklyn, N. Y., conduit assembly, ring assembly, Apr., 1950, $3063.

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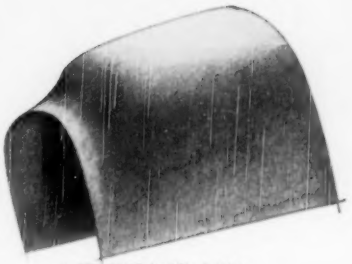

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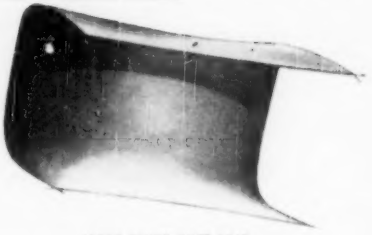
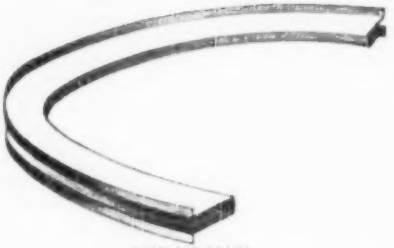
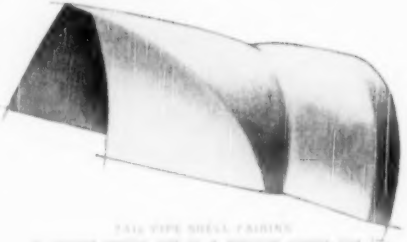


INTER SCOOP DUCT SKIN



FUSELAGE FRAME



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Franklin Institute, Philadelphia, research, human frequency response, Apr., 1951, $63,457.

Fyr-Fyter Co., Dayton, fire extinguisher, June, 1950, $2026.

Gardner, Inc., Cincinnati, machine key duplicating automotive, July, 1950, $2193.

General Electric Co., Dayton, instrument control relay switch, percentage, differential—time overcurrent, June, 1950, $1237.

General Electric Co., Schenectady, N. Y., nut and retainer assemblies, June, 1950, $4447; revisions of handbook data, May, 1950, $5645; spare parts for turbos and turbo regulators, July, 1950, $44,000; spare parts for superchargers and turbo regulators, June, 1950, $25,000; spare parts for fire control systems of the B-29, B-50 and B-36 airplanes, Jan., 1951, $84,552; position indicator, type A-7, July, 1951, $27,222; position indicator and position transmitter, July, 1950, $4369; technical data covering thermocouple, tail pipe temperature and actuator, Aug., 1950, $4546.

General Electric Co., Syracuse, N. Y., 40 each, wave guides, GE type, July, 1950, $50,000; 15 each, motors, Dec., 1950, $6480.

General Electric Supply Corp., Dayton, spare parts for F-1, F-1A and F-2 and F-2A trailer, June, 1950, $20,810; extension-cord 2 conductor 18 AWG type SJ cable, Mar., 1950, $2502; plugs, Mar., 1950, $1966.

General Lamps Mfg. Corp., Elwood, Ind., lamp assembly, Mar., 1950, $1428.

General Radio Co., Cambridge, Mass., generator—standard signal, May, 1950, $1225.

Georgia Institute of Technology, Atlanta, services, research on development of twist on rayon, orlon and nylon, Sept., 1950, $10,010.

Germanow, Simon Machine Co., Rochester, watch crystals, Mar., 1950, $2675.

Gilfillan Bros., Inc., Los Angeles, services of field engineer, Mar., 1950, $1950; electrical-indicator, May, 1950, $4339.

Globe-Wernicke Co., Washington, D. C., bookcase bases and steel sections, Apr., 1950, $22,455.

Goodrich, B.F., Co., Akron, spare parts for C-47 aircraft, June, 1950, $4739; nose wheels, Dec., 1950, $24,328; nose wheels, Sept., 1950, $7937; rubber matting, May, 1950, $7947; maintenance data, May, 1950, $1278; airplane tubes, Aug., 1951, $4782; nose wheels and parts, Aug., 1950, $4719; wheels brakes spare parts, Apr., 1950, $4588; aircraft casings, July, 1950, $10,439.

Goodyear Aircraft Corp., Akron, modification of Douglas C-54D, stabilizer and rudder assembly for radar purposes, Apr., 1950, $16,543.

Goodyear Tire and Rubber Co., Inc., Akron, wheels and brakes spare parts, Dec., 1950, $45,851; brake assemblies, Aug., 1950, $11,487; nose wheels, Dec., 1950, $20,666; tail wheels, Sept., 1950, $13,041; nose wheels, Nov., 1950, $6647; 46 x 9 wheels and strain gage study of 17 stress coat, July, 1951, $26,636; aircraft casings, Jan., 1951, $19,264; aircraft casings, Nov., 1950, $32,601; aircraft tubes, Nov., 1950, $4472.

Gosiger, C. H., Machine Co., Dayton, band saws, Mar., 1950, $2823.

Gayle, George W. Son, Frankfort, Ky., adapters—aircraft, May, 1950, $1817.

Graf, V. L., Co., N. Baltimore, Mich., elbow and nipple, May, 1950, $1500; elbow, May, 1950, $6573; aircraft nuts, Apr., 1950, $1132.

Graflex, Inc., Rochester, miscellaneous photographic equipment, June, 1950, $26,689.

Grand Machine Co., Detroit, aircraft bolts, May, 1950, $1310.

Graybar Electric Co., Inc., Dayton, lamp assembly, Feb., 1950, $17,950.

Great American Industries div., Connecticut Telephone and Electric Corp., Meriden, plug, May, 1950, $2883.

Greer Hydraulics, Inc., Brooklyn, N. Y., starter stand assembly, prony brake type B-1, Mar., 1950, $2990.

Grimes Mfg. Co., Urbana, Ohio, fuselage, light assembly, Apr., 1950, $6649; 75 watt lamps and light assemblies, aviation, green, red, yellow and white, Mar., 1950, $1508.

Hamilton Standard Propeller div., United Aircraft Corp., Hartford, Conn., modification of QEP model No. 24F60-72 B6521A-6 to 24W60-345 B6521A-6, Mar., 1950, $21,467; modification of integral oil control assemblies, Mar., 1950, $21,655; stress survey of oil system, June, 1950, $6500.

Hartman Electrical Mfg., Mansfield, Ohio, cut-out, reverse current generator overvoltage relay, Oct., 1950, $44,766.

Hathaway Instrument Co., Denver, photographic papers and charts, Mar., 1950, $10,000.

Heil-Coil Corp., L. I. City, N. Y., taps, gages, inserters and extractors, Mar., 1950, $4351.

Helliderfer-Castellini, Dayton, install systems, study equipment, Aug., 1950, $15,500.

Hewitt Rubber of Buffalo div., Hewitt-Robins, Inc., Buffalo, hose gasoline thin wall, July, 1950, $27,843.

Higgins, William, Sons, Buffalo, dismantling and crating for shipment, loading on carrier and blocking of certain government-owned machinery and equipment located at the plant of Playboy, Inc., Tonawanda, N. Y., Mar., 1950, $12,184.

Hoyt Electrical Instrument Works, Cambridge, Mass., voltmeter-switchboard D C O-150 V round flush MTG bakelite case, Apr., 1950, $1380.

Huffman Mfg. Co., Dayton, copperized 1 gal. measures, June, 1950, $7610.

Hughes Aircraft Co., Hollywood, Calif., maintenance data, Mar., 1950, $1626.

Hughes-Simonson Engrg. Co. Dayton, installation 3000 PSI pressure compressor, Apr., 1950, $2700.

Hulbert Mfg. Co., Ashtabula, Ohio, floor-creeper, pivoting caster, Feb., 1950, $3750.

Hunter Mfg. Co., Cleveland, spare parts for UH-2 heaters, May, 1950, (two contracts) $2744, $1967.

Hydrographic Office U. S. Navy Dept., Washington, D. C., publication, Mar., 1950, $7610.

Ideal Lab. Tool Supply Co., Cheyenne, Wyo., demonstrator trainer, Aug., 1950, $16,755.

Illinois Glove Co., Champaign, Ill., 2000 pair N-4 mittens large, 8000 pair N-4 mittens medium, June, 1950, $54,800.

Interstate Engr. Corp., El Segundo, Calif., nose gear strut assembly for B-26 aircraft, Feb., 1950, $12,571.

Jack-Heintz Precision Inds., Cleveland, generators, regulators and panel assembly, Dec., 1950, $35,000; tachometer generator, Dec., 1950, $20,699.

Jacobs Aircraft Engine Co., Pottstown, Pa., services and materials to overhaul R-755-11 engines, June, 1950, $21,000.

Johns-Manville Sales Corp., Cleveland, asbestos cloth, Apr., 1950, $2277.

Kaiser Frazer Corp., Willow Run, Mich., storage services in Bohn aluminum plant, Adrian, Mich., Dec., 1950, $16,832.

Kas-Kel Electrical Co., Inc., New York, cord-extension 50 ft. 2 conductor AWG type SJ cable, Mar., 1950, $2621.

Kearfoot Co., Inc., New York, technical data for wiper assembly, May, 1950, $1902; spare parts for wiper assembly, Apr., 1950, $2383.

Kidde, Walter, and Co., Inc., Belleville, N. J., fire extinguishers, July, 1950, $5200.

Kinsey, E. A., Co., Cincinnati, milling machine, horizontal plain, Apr., 1950, $19,546.

Kollsman Instrument div., Square D Co., Elmhurst, N. Y., torque pressure gages, Oct., 1950, $5058; manifold pressure transmitters, June, 1951, $32,621; airspeed indicators, Sept., 1950, $87,524; airspeed indicator, pitot static types, Dec., 1950, $81,827; transformer and test fixture, Apr., 1950, $1925.

Kulman Electric Co., Bay City, Mich., transformer and fuse box, Mar., 1950, $1027.

Laird Engrg. Co., Charleston, W. Va., thermometer test stand assembly, May, 1950, $2792.

Lapine, Arthur S., and Co., Chicago, photographic chemicals, Mar., 1950, $2279.

Lear, Inc., Grand Rapids, experimental flight indicator, Dec., 1950, $14,956; modification of controls, Aug., 1950, $71,775; actuator assembly, automatic temperature control, spare parts and technical data, July, 1950, $96,754.

Leland Electric Co., Dayton, inverter, laboratory equipment, May, 1950, $5163.

Lewis Engineering Co., Naugatuck, Conn., temperature indicator, type H-1, Mar., 1951, $13,757; temperature indicator, type G-3, May, 1950, $3423; bulb, Apr., 1951, $2054; temperature indicator, type S-7, May, 1951, $17,626; maintenance data, Apr., 1950, $1329; maintenance data, Apr., 1950, $1430; maintenance parts for temperature indicators, Apr., 1950, $1288.

Liberty Mirror, Brackenridge, Pa., mirror, May, 1950, $2537.

Linde Air Products Co., New York, liquid oxygen and nitrogen, June, 1950, $21,336.

Liquidometer Corp., L. I. City, N. Y., tank unit, June, 1950, $1186.

Litton Industries, San Carlos, Calif., magnetrons, Apr., 1950, $9000.

Lockheed Aircraft Corp., Burbank, Calif., services of technical representatives, June, 1950, $58,218.

Lockheed Aircraft Service, Inc., Burbank, Calif., spare parts for F-80 aircraft, June, 1950, $2057.

Lycoming Div., Avco Manufacturing Corp., Williamsport, Pa., emergency spare parts for O-435-1 and O-435-11 engines installed in L-5 aircraft, June, 1950, $21,500.

Machine Products Co., Wichita, extension of contract period maintenance contract at Wichita, Dec., 1949, $33,622.

Magnolia Airco Gas Prod. Co., Houston, breathing oxygen, Dec., 1950, $2841.

Mallinckrodt Chemicals Works, St. Louis, photographic chemicals, Mar., 1950, $48,960.

Management and Research, Inc., Primos, Pa., mock-up and demonstrator trainers, Sept., 1950, $7600.

Manhattan Lighting Equipment Co., New York, fuse extractor post, Mar., 1950, $2222; oven electric pot electric, Apr., 1950, $3325.

Federal Mogul Corp., Waukesha, Wisc., spare parts for bearings, Oct., 1950, $14,150.

Marinette Glove Co., Inc., Marinette, Wisc., N-3 mitten 10,000 pair, N-2 mitten 10,000 pair, July, 1950, $27,200.

Marlin-Rockwell Corp., Jamestown, N. Y., ball bearings, May, 1950, $38,390.

Marmon Products Co., Inglewood, Calif., clamps, Apr., 1950, (two contracts) $2874, $6150.

Marvel, A., Co., Caldwell, N. J., propeller balancer assemblies and stand, Sept., 1950, $76,945.

McGill Mfg. Co., Valparaiso, Ind., bearings, May, 1950, $15,290.

McLean Development Labs., Dallas, wing tip rack and gear type bomb ejectors, Sept., 1950, $29,214.

McQuay-Norris Mfg. Co., St. Louis, switch assembly, Apr., 1950, $2984.

Mead Aviation Equipment Co., Trenton, N. J., parachute assembly, emergency sustenance kit, June, 1950, $60,600.

Meriam Instrument Co., Cleveland, automatic pilot assembly stand and compass assembly stand, May, 1950, $4310.

Metal Hose and Tubing Co., Dover, N. J., gasoline hose, June, 1950, $46,834.

Metal Trims, Inc., Youngstown, print washer, Apr., 1950, $4230.

Meyer, Hugo, Co., New York, miscellaneous photographic equipment, Mar., 1950, $1840.

Michigan Bolt-Nut Co., Inc., Detroit, nuts, July, 1950, $1871.

Michigan Wire Cloth Co., Detroit, funnels, May, 1950, $3336.

Midland Co., Kansas City, crystal units, May, 1950, $19,196.

Midwest Research Institute, Kansas City, reports presenting theoretical studies of the effects of aspect ratio on straight and swept wing flutter, Aug., 1950, $4028.

Miller, William, Corp., Pasadena, Calif., galvanometers, Apr., 1950, $1650.

Mines Equipment division, St. Louis, spare parts for B-29 aircraft, Apr., 1950, $3060.

Minneapolis-Honeywell Regulator Co., Minneapolis, B-4 turbo regulator system components, June, 1950, $3716; cabinstat and cap, May, 1950, $8600; autopilot spare parts, Dec., 1950, $19,715; altitude controls, May, 1950, $12,559; automatic trim controls, June, 1950, $13,515.

Minneapolis-Honeywell Regulator Co., Philadelphia, potentiometer, Mar., 1950, $1840.

Model Engr. Mfg. Co., Huntington, Ind., fuel system date plate, Apr., 1950, $2370.

Monadnock Mills, S. Leandro, Calif., cowling fastener, May, 1950, $5638.

Monterey Products Co., El Monte, Calif.,

front and rear propeller cones, May, 1950, $3576.

Moody D and Co., Tulsa, heater assembly, Mar., 1950, $16,250.

Morse Instrument Corp., Hudson, Ohio, glass vertical viewfinder, May, 1950, $3655; printer assemblies, Aug., 1950, $78,772.

Munston Mfg. and Service, Inc., New York, relays, May, 1950, $4407.

National Bureau of Standards, Washington, D. C., development of production techniques in the manufacture of optical glass, Feb., 1952, $25,000; crazе and crack resistance of laminated acrylic plastic research, Feb., 1951, $12,500; construction of infrared punchcard system, Feb., 1951, $10,000.

National Lock Co., Rockford, Ill., aircraft bolts, May, 1950, $2537.

North American Aviation, Inc., Los Angeles, services of technical representatives, June, 1950, $56,302; modification kits for F-86A airplane, Sept., 1950, $76,918; spare parts for P-93 airplane, Apr., 1950, $36,157; pneumatic gun charging system on YF-93A airplane and nose gun firing section, Apr., 1950, $3852; spare parts for T-6 and T-51 aircraft, June, 1950, $65,000.

Northrop Aircraft Inc., Hawthorne, Calif., spare parts for YC-125A and B aircraft, Nov., 1950, $20,000; revised model specifications for the YC-125A and YC-125B aircraft, Dec., 1950, $1811.

Nosker Engrg. Products, Yellow Springs, Ohio, repair and modernize control unit, six channel oscillograph, May, 1950, $1350.

Nutt-Shel Co., Los Angeles, aircraft nuts, Apr., 1950, (two contracts) $3150, $3150.

OPW Corp., Cincinnati, fuel servicing system nozzle, nipple, Apr., 1950, $1124.

Oak Mfg. Co., Chicago, switches, June, 1950, $57,120.

Octagon Process, Inc., Brooklyn, N. Y., photographic chemicals, Feb., 1950, $17,726.

Ohio State University Research Foundation, Columbus, research guidance and planning program, Mar., 1952, $20,000; crew composition study, June, 1950, $9400; study drum failures and develop information to insure the use of suitable materials for handling fuming nitric acid, Mar., 1951, $25,516; conduct research analysis and investigation in connection with the problem of the development of suitable techniques for use in development of infrared band pass detector, Mar., 1951, $10,645.

Onan, D. W., and Sons, Inc., Minneapolis, armature relay, Apr., 1950, $1037.

Pacific Piston Ring Co., Los Angeles, elbows, May, 1950, $1423; aircraft elbows and tees, May, 1950, $1806.

Pako Corp., Minneapolis, print dryer and spares, Jan., 1951, $44,705; miscellaneous photographic equipment, Apr., 1950, $4374; spare parts for photographic equipment, Apr., 1950, $2148.

Parker Appliance Co., Cleveland, hose adapters and unions, May, 1950, $1500.

Patterson Moos Co., L. I. City, N. Y., relay for experimental purposes, May, 1950, $5000.

Pease, C. L., Co., Chicago, blueprint filing section and bases, May, 1950, $14,732.

Pesco Products div. Borg-Warner Corp., Bedford, Ohio, fuel booster pumps, June, 1950, $4780.

Peter Research, Newark, N. J., fire detectors, Mar., 1951, $26,600.

Philco Corp., Philadelphia, domestic service, field engineers, June, 1950, $69,972; services of overseas and domestic field engineers, Nov., 1949, $45,511.

Phipps Products Co., Boston, dry powder fire extinguishing agent, Feb., 1950, $8500.

Phoenix Trimming Co., Chicago, parachute webbing, June, 1950, $46,223.

Photoswitch, Inc., Cambridge, Mass., switches for fire detector equipment, Mar., 1950, $1067.

Pierce Governor Co., Anderson, Ind., gear drive shaft and governor assembly, June, 1950, $13,430.

Pierson Elec-Engrg. Corp., Los Angeles, technical data—generator assembly, Apr., 1950, $1570.

Pioneer Parachute Co., Manchester, Conn., parachute suspension line, Feb., 1951, $19,981.

Pollak Engineering Co., Newark, N. J., container assembly, May, 1950, $24,850.

Price Electric Corp., Frederick, Md., relays, Apr., 1950, $2160.

Protectoseal Co., Chicago, gasoline-oil-can, May, 1950, $7700; gasoline cans and tanks, Apr., 1950, $12,133.

Pryne, William, Inc., Dayville, Conn., tee head pins, July, 1950, $2713.

Purdue Research Foundation, Lafayette, Ind., adhesion of strain gages, Dec., 1950, $5224.

Purolator Products, Inc., Newark, N. J., hydraulic filter elements, July, 1950, $13,500.

Pyle-National Co., Chicago, receptacles, Mar., 1950, $1052.

RCA Victor div. Camden, N. J., film recording equipment, Mar., 1950, $2050.

Radioplane Co., Van Nuys, Calif., modification of OQ-19A wings to rotary launcher, Sept., 1950, $8018; noise filter and kits, Mar., 1950, $1659; fabrication and installation of telemetering on OQ-19A, May, 1950, $44,594; rotary launcher for O-19 aerial targets and spare parts, June, 1950, $42,687.

Ranger Aircraft Engines div., Fairchild Engine and Airplane Corp., Farmingdale, N. Y., spare parts, screw casket kit, case, etc., July, 1950, $5463.

Rano Machine-Tool Corp., Buffalo, N. Y., aircraft bolts, May, 1950, $2221.

Ranoshoff, N., Inc., Cincinnati, milling machine, bench type, horizontal, Apr., 1950, $4075.

Recordiak Corp., Washington, D. C., photographic film, Mar., 1950, $10,975.

Reed Products, Inc., Milwaukee, high altitude flying mask, June, 1950, $29,957.

Reeves-Hoffman Corp., Carlisle, Pa., crystal units, Apr., 1950, $1200.

Reeves Instrument Corp., New York, polynomial plotter, Nov., 1950, $50,000.

Republic Aviation Corp., Farmingdale, N. Y., spare parts for F-84 and F-47 aircraft, July, 1950, $90,342; spare parts for F-47 aircraft, July, 1950, $13,035; kits for rework of wings on F-84 aircraft, Feb., 1950, $10,466; services of overseas technical representatives, June, 1950, $18,126; test stand, Mar., 1950, $2456; fire pilots ejection seat, Feb., 1950, $3046.

Rhodes Lewis Co., Culver City, Calif., modification of K-24 cameras and drawings, Dec., 1950, $19,750; jettisonable rocket launcher housing, Sept., 1950, $13,250; drawings and specifications for solenoid hook and rocket arming, Mar., 1950, $8750.

Richardson Bellows Henry Co., New York, research on a ground accident report form, June, 1950, $10,624.

Rochester Mfg. Co., Rochester, N. Y., thermometer type C-17, July, 1950, $2615.

Rockford Clutch div., Borg-Warner Corp., Rockford, Ill., spare parts for clutches and transmissions, Sept., 1950, $2396.

Rosen, Raymond, Engr. Prod., Inc., Philadelphia, dynamotor commutators, Mar., 1950, $1960.

Rutgers University, N. Brunswick, N. J., research to obtain fundamental information on ternary systems of metal-ceramic bodies containing MgO-tin-NiO, Apr., 1951, $17,636.

Ryan Aeronautical Co., San Diego, spare parts for C-74 aircraft, June, 1950, $23,102.

S-K Screw Products Co., Los Angeles, elbow tee union, May, 1950, $1463.

Sanford Aircraft, Inc., Inglewood, Calif., aircraft nuts, Apr., 1950, $1875.

Schenult, F. G., Rubber Co., Baltimore, aircraft casings, Nov., 1950, $3562.

Schwien, L. N., Engraving Co., Los Angeles, spare parts for bank and turn indicators, Apr., 1950, $7204; vertical gyro indicator, June, 1950, $57,733; turn and bank indicator, type C-3, June, 1950, $66,338.

Scintilla Magneto div., Bendix Aviation Corp., Sidney, N. Y., technical data for switch assembly, May, 1950, $1392; maintenance and overhaul spare parts for magnetos used on R-1300-1 and R-1820-76 engines, May, 1950, $2379; maintenance and overhaul spare parts for ignition equipment, Aug., 1950, $1027.

Seaboard Electric Co., New York, flashers, June, 1950, $14,068.

Seamless Rubber Co., New Haven, Conn., bladder assembly, July, 1950, $9960.

Sierra Engineering Co., Sierra Madre, Calif., anthropometric dummy, Oct., 1950, $19,746.

Sikorsky Aircraft div., United Aircraft Corp., Bridgeport, Conn., spare parts for H-5 aircraft, July, 1950, (two contracts) $18,410, $4602.

Singer Sewing Machine Co., New York, sewing machines with stands, Aug., 1950, $16,455.

Skinner Purifiers div., Bendix Aviation Corp., Detroit, hydraulic filter element, July, 1950, $20,900.

Solar Aircraft Co., San Diego, spare parts for F-86 aircraft, July, 1950, (three contracts) $6270, $4560, $7307.

South Wind div., Stewart-Warner Corp., Indianapolis, bellows switch assembly, Aug., 1950, $12,198.

Specialty Assembly and Packaging Co., Brooklyn, N. Y., fabrication of B-7A switches, July, 1950, $16,656.

Spencer Thermostat, Attleboro, Mass., circuit breakers, Mar., 1950, $1243.

Sperry Gyroscope Co. div., Sperry Corp., Great Neck, N. Y., compass indicators, V-2, Feb., 1951, $6880; compass indicators, V-4, Feb., 1951, $68,840; compensator, May, 1950, $9413; altitude controls turn generator assemblies, Oct. 1950, $9965; handbook data for compass systems, June, 1950, $8874.

Watson Lab

Network Mfg. Corp., Bayonne, N. J., three modified antenna pattern analyzer, group AN-JRM-16, June, 1950, $4400.

Photographic Products, Inc., Hollywood, Calif., photographic unit for GCA evaluation, Mar., 1950, $16,097.

Processing Equipment Corp., Hillside, N. J., one each high voltage regulator 187 power supply, Aug., 1950, $10,069.

Cambridge

Brujac Electronic Corp., New York, oscilloscope, cathode ray, oscilloscope features, Apr., 1950, $12,548.

Commander Boston Naval Yard, Boston, services and materials necessary to fabricate one each antenna table, Apr., 1950, $1300.

Consolidated Engrg. Corp., Pasadena, Calif., oscillograph, June, 1950, $7610.

DuMont, Allen B., Labs., Inc., Clifton, N. J., cathode ray oscillograph for 115v 60-cycle using 5CP1A cathode ray tube, Feb., 1950, $8482.

Electro Mechanical Research, Ridgefield, Conn., one each infra-red measuring equipment, Jan., 1950, $3321.

Flader, Frederic, Inc., N. Tonawanda, N. Y., set recorder electrostatic AN-ASH-1, May, 1950, $4508.

Johnson, Walter J., Inc., New York, research texts, Feb., 1950, $3885; research texts, Mar., 1950, $1405.

Kann-Ellert Electronics, Inc., Baltimore, chassis metal plate tube type 2J67, Mar., 1950, $6625.

Kennedy, D. S. and Co., N. Scituate, Mass., services and materials necessary for the volie antenna, Feb., 1950, $1250.

Leeds and Northrup Co., Philadelphia, bridge, wheatstone anthony pattern, June, 1950, $1382.

New York University, New York, research on atmospheric heat balance, Nov., 1951, $20,000.

Philco Corp., Philadelphia, tube quadrature—quanizer, May, 1950, $4500.

Polytechnic Research and Development Co., Brooklyn, N. Y., termination fixed waveguide attenuator detector tuners, adapter, bend tee, etc., June, 1950, $6692.

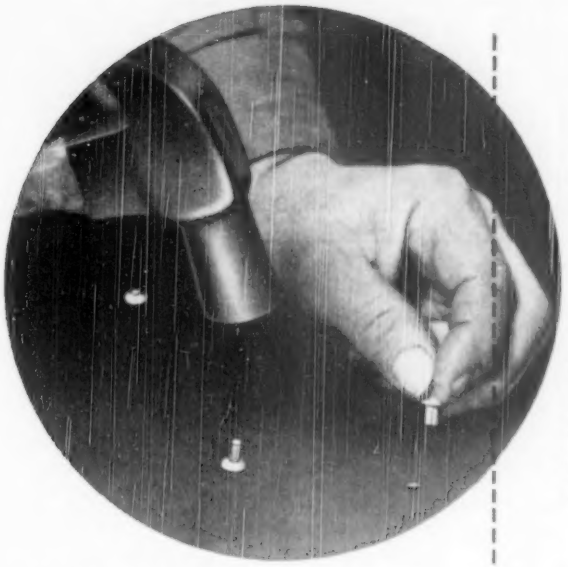
RCA Victor div. Camden, N. J., tube, storage, modified radechon, May, 1950, $1475.

Raytheon Mfg. Co., Waltham, Mass., tube, reflex klystron, oscillator, Apr., 1950, $1963.

Steiner, William F., Silver Springs, Md., equipment, wall conductivity, model W1, June, 1950, $5890.

University of Denver, Denver, experimental investigation, June, 1951, $37,600.

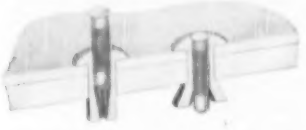
University of Saskatchewan, Saskatoon, Canada, basic research on the aurora and excitation processes in the upper atmosphere, Jan., 1952, $50,000.



save time

drive rivets with a hammer

As simple as hammering nails, you can save valuable time on sheet metal assembly jobs with Drive-Pin Rivets. There are no special procedures, no special tools with the Cherry Rivet Company's series of Drive-Pin *blind* Rivets.



When installed, the serrated pin is driven into the tapered hole in the rivet. The surrounding section of the rivet shank is first expanded into the hole in the material; then the four sections of the protruding end of the shank expand to form a blind head at the back of the work.

Available in six diameters in steel (3/32", 1/8", 5/32", 3/16", 7/16", and 1/2") and three diameters in aluminum (3/32", 1/8", and 5/32"). Grip lengths for material thicknesses from 1/8" to 1 1/16". Brazier and Countersunk (100°) head styles.

Drive-Pin Rivets are ideal for fastening light sheet to heavier sheeting or to framework where rigidity is great enough to withstand hammering. Driving the pin forces the head of the rivet against the top sheet. In turn, the top sheet is forced against the material beneath. The rivet forms a tight head on the blind side.

drive-pin rivet advantages

1. Installed by one man working from one side of the job.
2. An ordinary hammer is the only installation tool needed.
3. Requires very little preparatory instruction on the job.
4. Unusually good material thickness tolerance.
5. Hole-filling qualities are exceptional.

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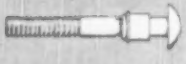
BLIND BOLT. A large-diameter, blind fastener designed for heavy sheet metal jobs where access to the job is blind or limited. Blind Bolts install fast . . . they have strength characteristics equal to or greater than AN bolts.



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Damon, Patterson Top Salary List

Airline payments to employes in 1949 generally higher than in 1948, with average rising from $3600 to $3800.

Airline paychecks during 1949 were fatter than ever before.

Both top executives and lower-bracket personnel shared in the salary gains. Average domestic airline employe received more than $3800 in 1949, compared with about $3600 in 1948.

Some carriers, such as Delta, Northwest and Western, made few increases last year in executive salaries. But even here the average pay for other employes of the companies rose substantially.

▶ **Damon, Patterson Lead**—Top salary of $62,500 went to two airline presidents last year—Ralph Damon, TWA, and W. A. Patterson, United Air Lines. Which of these was actually the top-paid executive in the industry is open to question.

Damon, who during 1948 received $40,000 as president of American Airlines, didn't take over as TWA president until Feb. 10 of last year. His contract provides for a $75,000 salary on a full-year basis.

In addition to his $62,500 salary, Patterson last year received $26,915 in indirect compensation, representing United's contribution toward the executive's retirement plan. Patterson also made $62,500 in 1948, but received only $5229 in company-paid retirement plan contributions.

▶ **Other Presidents**—C. R. Smith was paid $50,000 as president of American Airlines last year, compared to the $60,000 he received as AA board chairman in 1948. T. E. Braniff, president of Braniff Airways, received $28,500 in salary plus $3256 in indirect compensation during 1949, compared with $24,000 plus $2925 in indirect compensation in 1948.

Salary of Capital Airlines President J. H. Carmichael rose from $27,500 in 1948 to $35,000 last year; Chicago & Southern President Sidney Stewart went from $25,416 to $30,000; Colonial President Sigmund Janas from $18,000 to $24,500; National President G. T. Baker from $26,250 to $33,750; Northeast President George Gardner from $16,850 to $17,900 and TWA Board Chairman Warren Lee Pierson from $50,000 to $58,749.

Slick Airways President Earl F. Slick received no salary as head of his all-cargo company during 1949, and the same was true of Harry R. Playford, president and board chairman of U. S. Airlines.

Average Airline Salaries

Carrier	1949	1948
American	$3907	$3603
Braniff	3522	3258
Capital	3921	3650
Chi. & So.	3713	3605
Colonial	3923	3552
Continental	3894	3573
Delta	3504	3161
Eastern	3727	3733
Inland	4348	3952
Mid Continent	3551	3113
National	3708	3267
Northeast	3715	3539
Northwest	4235	3841
TWA	3936	3638
United	4128	3967
Western	4192	3764

* Domestic payroll as of fourth quarter of each year.

Other airline salaries last year, with 1948 payments, where available, in parentheses:

▶ **American**—O. M. Mosier, vp, $27,500 ($25,000); R. E. S. Delehler, vp, $27,500 ($23,333); L. G. Fritz, vp, $27,500 ($24,166); W. J. Hogan, vp-treas. $27,500 ($23,333); William Littlewood, vp, $27,500 ($25,000); C. W. Jacob, vp-secty., $22,500 ($19,333); Rex Smit, vp, $21,250 ($19,166); Amos Culbert, vp, $20,000 ($20,000); Glen Markt, asst. vp, $9429; W. H. Miller, asst. vp, $18,000 ($17,666); Carlene Roberts, asst. vp, $14,250 ($12,000); C. R. Speers, asst. vp, $16,500 ($12,838); P. G. Larle, comptroller and asst. treas., $16,000 ($15,466); V. J. Long, asst. secty and asst. treas., $13,500 ($13,500); W. L. McMillen, asst. secty. and asst. treas., $13,100 ($11,233); T. O. English, asst. treas., $10,200 $6750); L. E. Glasgow, asst. comptroller and asst. treas., $10,578; C. H. Kibbee, asst. treas., $14,300 ($13,200); A. A. Paradis, asst. secty., $7500 ($6666); A. R. Bone, regional vp, $11,869 ($10,499); W. N. Bump, regional vp, $11,500 ($10,749); Walter Johnson, regional vp, $11,000 ($7693); Stanley King, regional vp, $12,000 ($2177); M. D. Miller, regional vp, $12,750 ($11,499).

Stockholders with more than 5 percent of American's outstanding capital stock as of Dec. 31, 1949: none.

▶ **Braniff**—R. C. Shrader, vp, $16,875 plus $1832 indirect ($15,000 plus $1697); charles Beard, vp, $23,000 plus $1890 ($20,000 plus $1671); C. G. Adams, secty.-treas., $16,875 plus $2568 ($15,000 plus $1433); Hal Thurman, gen. counsel, $15,000 plus $999 ($15,000 plus $1005); John Walker, vp, $11,666; Oscar Crane, asst. treas., $8400 plus $522 ($7500 plus $625); R. L. Barrier, asst. secty., $7200 plus $428 ($6600 plus $550).

Stockholders with more than 5 percent: T. E. Braniff, 27.98 percent; the Braniff Foundation 6.26 percent.

▶ **Capital**—R. G. Lechlet, vp-treas., $23,500 ($20,365); J. W. Austin, vp, $18,000 ($16,875); J. B. Franklin, vp, $18,000 ($15,750); R. J. Wilson, vp, $17,760 ($16,560); Hayes Dever, secty., $14,000 ($12,874); R. P. Wright, asst. treas., $10,875 ($9780); C. H. Murchison, chairman of executive committee, $15,000 (none).

Stockholders with more than 5 percent: none.

▶ **Chicago & Southern**—Carleton Putnam, board chairman, $26,000 ($26,000); Junius Cooper, vp, $18,000 ($15,250); William Arthur, vp, $11,278; Richard Maurer, secty. and gen. counsel, $12,666 ($12,000); Thomas Hambleton, treas., $7000 ($6400); Robert Scrivener, asst. treas., $5160 ($5160); Erma Murray, asst. secty., $4589 ($4680).

Stockholders with more than 5 percent: Carleton Putnam, 10.76 percent; I. M. Simon & Co., St. Louis, 12.62 percent.

▶ **Colonial**—Edward Ridley, vp, $10,999 ($9999); Alfred Hudson, vp, $10,999 ($9999); Branch Dykes, vp, $15,000 ($15,000); Sigmund Janas, Jr., vp, $10,999 ($9,199); James Gormley, treas., $11,416 ($9166); Warren Cooper, secty., $7950 ($6375).

Stockholders with more than 5 percent: Sigmund Janas, 7.16 percent; Merrill Lynch, Pierce, Fenner & Beane, 5.23 percent.

▶ **Continental**—Louis Mueller, board chairman, none (none); Robert Six, president, $30,000 ($29,791 plus $15,000 indirect); C. C. West, vp, $15,000 ($14,916); O. R. Haueter, vp, $15,000 ($14,958); Joseph Uhl, vp, secty.-treas., $12,916 ($11,916); Ronald Kinsey, vp, $10,382 ($9999); Dorothy Rylander, asst. secty., $3966 ($3509).

Stockholders with more than 5 percent: Estate of W. R. Erhart, 20 percent; Louis H. Mueller, 7 percent.

▶ **Delta**—C. E. Woolman, president-gen. man., $24,000 ($24,000); C. E. Faulk, board chairman, $12,000 ($12,000); Charles Dolson, vp, $16,000 ($16,000); Laigh Parker, vp, $18,000 ($18,000); L. B. Judd, comptroller and asst. secty., $10,800 ($10,800); M. S. Biedenharn, vp, none (none); Travis Oliver, treas., $1200 ($1200); C. H. McHenry, secty., $1200 ($1200); Catherine Fitzgerald, asst. treas., $4150 ($3900).

Stockholders with more than 5 percent: R. J. Reynolds, Winston Salem, N. C., 22.78 percent; C. E. Woolman, 6.46 percent.

▶ **Eastern**—E. V. Rickenbacker, president, $25,000 plus $5561 indirect through director's fees and retirement plan contribution ($35,000 plus $5361); Paul Brattain, first vp, $27,500 plus $4068 ($26,250 plus $3640); Sidney Shannon, second vp, $25,000 plus $2788 ($23,750 plus $2791); T. F. Armstrong, secty.-treas., $17,500 plus $2247 ($16,875 plus $2191); J. W. Moore, asst. secty. and asst. treas., $12,000 plus $1531 ($11,400 plus $1530); L. P. Arnold, vp, $17,500 plus $2025 $(16,875 plus $1796); M. M. Frost, vp, $22,500 plus $2182 ($21,875 plus $999); S. deJ. Osborne, vp, $22,500 plus $1763 ($21,875 plus $1606).

Stockholders with more than 5 percent: Merrill Lynch, Pierce, Fenner & Beane, 5.09 percent.

▶ **Inland**—See Western, which holds 97.3 percent of Inland stock.

▶ **Mid-Continent**—T. F. Ryan, III, board chairman, none (none); J. W. Miller, president-gen. man., $24,999 plus $731 indirect ($24,343); J. C. Collins, vp-secty., $9999 plus $292 ($10,567); J. A. Cunningham, vp, $13,000 plus $353 ($12,617); H. W. Coburn, vp, $10,999 plus $648 ($10,567); C. H. Calhoun, vp, $10,999 plus $226 ($10,498); W. L. Walker, treas., $9000 plus $117 ($8225); W. D. King, asst. treas., $5800 plus $80 ($5353); P. H. Carr, asst. secty., $4900 plus $140 ($4556).

Stockholders with more than 5 percent: T. F. Ryan, III, 20.03 percent.

▶ **National**—J. L. Morris, vp, $12,750; J. D. Crane, vp, $11,674 ($10,225); E. J. Kershaw, vp, $17,000 ($14,999); Walter Sternberg, vp since Sept. 6, 1949, $5642; R. E. Wieland, vp, $6600; J. M. Rosenthal, vp, $10,499; R. P. Foreman, secty., $10,125 ($8625); J. C. Brawner, treas., $11,124 ($9375); T. A. Prevost, asst. vp, $10,624 ($9375); F. E. Howe, asst. secty. and asst. treas., $7500 ($6900); W. F. Johnston, asst. treas., $6750 ($6150); H. C. Dobbs, vp who resigned Aug. 2, 1949, $12,500 ($13,749).

Stockholders with more than 5 percent: G. T. Baker, 16.85 percent; W. R. Grace & Co., 17.4 percent.

▶ **Northeast**—Paul F. Collins, board chairman, none ($12,250); A. A. Lane, vp, $14,400 ($24,000); Hamilton Heard, treas., $12,000; R. B. Herrnstein, asst. treas., $7200 ($7500).

Stockholders with more than 5 percent: Atlas Corp. 22 percent common and 96 percent preferred.

▶ **Northwest**—Croil Hunter, president and general manager, $45,000 ($45,000); L. C. Glotzbach, vp and asst. to pres., $17,000 ($17,000); E. L. Whyatt, exec. vp, $20,000 ($20,000); A. E. Floan, vp-secty., $17,000 ($17,000); K. R. Ferguson, vp, $24,000 ($18,000); R. O. Hullwinkel, vp, $15,000 ($15,000); L. S. Holstad, treas., $15,024 ($15,000); Frank Judd, reg. vp, $15,000 ($15,000); D. J. King, reg. vp, $17,089 ($15,850); Charles Stearns, asst. secty., $5499 ($9930); W. J. Eiden, asst. treas., $10,800 ($10,800).

Stockholders with more than 5 percent: Merrill Lynch, Pierce, Fenner & Beane, 8.63 percent preferred and 4.32 percent common.

▶ **TWA**—E. O. Cocke, vp, $22,500 ($19,575); J. A. Collings, vp, $35,000 ($31,619); A. V. Leslie, vp-treas., $26,400 ($26,400); C. E. Fleming, vp, $17,375 ($15,000); G. H. Clay, secty., $12,919 ($10,867).

Stockholders with more than 5 percent: Hughes Tool Co., 73.57 percent.

▶ **United**—Harold Crary, vp, $21,000 plus $2975 indirect representing retirement plan contribution ($18,500 plus $2602); J. A. Herlihy, vp, $37,500 plus $2526 ($35,000 plus $2417); R. W. Ireland, vp, $25,000 plus $2931 ($20,000 plus $3389); Hal Nourse, vp, $18,999 plus $1432 ($17,500 plus $1337); R. F. Ahrens, vp, $19,000 plus $1314 ($17,416 plus $1219); Curtis Barkes, vp., $15,666 plus $922; D. F. Magarrell, vp, $20,500 plus $1216 ($17,416 plus $1066); S. P. Martin, secty., $12,000 plus $774 ($11,958 plus $743); C. H. Blanchar, comptroller, $11,700 plus $525 ($10,549 plus $475); N. B. Haley, treas., $13,000 plus $2071 ($13,000 plus $1966).

Stockholders with more than 5 percent: Ince & Co. New York, 5.34 percent preferred; Josaphthal & Co., New York, 6.25 percent preferred; Merrill Lynch, Pierce, Fenner & Beane, 5.75 percent common; W. A. Patterson, 13.64 percent management; Harold Crary, 5.46 percent management; R. W. Ireland, 5.46 percent management; J. A. Herlihy, 5.46 percent management.

▶ **Western**—T. C. Drinkwater, president, $34,999 plus $300 indirect ($34,999 plus $100); S. R. Shatto, vp, $15,000 plus $200 ($15,000 plus $100); M. W. Landes, vp, $10,000 ($10,000); R. A. Dick, vp resigned Oct. 31, 1949, $8865 ($10,000); A. F. Kelly, vp, $1666; P. E. Sullivan, vp-secty., $10,200 ($10,200); D. P. Benda, asst. secty., $41666 ($625); J. J. Taylor, treas., $9900 ($9500); R. H. Purcell, controller and asst. treas., $7650 ($7200).

Stockholders with more than 5 percent: Burnham Co., New York; Merrill Lynch, Pierce, Fenner & Beane, New York; Walston, Hoffman & Goodwin, New York.

▶ **Slick Airways**—Lewis Moorman, exec. vp, none; Thomas L. Grace, vp, $9150; Joseph F. Grant, secty., $8820; David Stewart, treas., $8497; William E. Miller, asst. secty., none.

Stockholders with more than 5 percent: Guaranty Trust Co. of New York, 19.3 percent; Harris Trust Savings Bank, Chicago, 19.3 percent; Earl F. Slick, 5.6 percent; Tom B. Slick, 27.6 percent; Charles F. Urschel, Jr., 5.5 percent; Mrs. Hernice Slick Urschel, 5.5 percent.

▶ **U. S. Airlines**—R. W. Starkey, vp and general manager, $10,000; H. F. Gravely, secty-treas., $7200.

Stockholders with more than 5 percent: H. R. Playford, 23 percent.

▶ **Caribbean-Atlantic Airlines** — Dionisio Trigo, president, $10,000 ($10,000); Benigno Trigo, vp, $3500 ($1013); Manuel Rivera, vp, $5460 ($6909); Frank Sheldon, vp, $2100; Jose Sierra, vp, $10,000 ($9300); Adolfo Valdes, secty., $1500 ($429); L. A. Lockhart, treas., $7200 ($6900).

Stockholders with more than 5 percent: Dionisio Trigo, 24 percent; Benigno Trigo, 24 percent; Juan Trigo, 18.2 percent; Henry Molina, 6.9 percent.

▶ **Hawaiian Airlines**—Stanley Kennedy, president, $27,500 ($14,400); Alexander Smith, vp-secty., $14,000 ($14,000); Ford Studebaker, vp, $14,000 ($14,000); David Watson, treas., $11,000 ($11,000).

Stockholders with more than 5 percent: Inter-Island Steam Navigation Co., 87.31 percent.

▶ **Trans-Pacific Airlines**—Ruddy F. Tongg, president, $9000; H. K. Hee, treas., $8600; Archie Wong, secty., $3200; William Randall, vp, $7275.

Stockholders with more than 5 percent: Jacob Ing, Honolulu, 6.45 percent.

NAL Traffic Soars

National Airlines celebrated completion of the biggest traffic month in its history by announcing the purchase of two more DC-6s.

President G. T. Baker said March revenue passenger mileage totaled 29,304,000, up 11 percent over February (the previous record month), and 53 percent ahead of March, 1949. Passenger load factor last month was 61.1 percent—nine percent higher than the year before.

The two newly ordered DC-6s are to be delivered before next winter's busy Florida vacation season. Two other DC-6s ordered last fall are to go in service this summer. NAL now has four DC-6s in operation.

▶ **Excursion Fares**—Meanwhile, National is aiming for its biggest summer season despite a recent rebuff by the Civil Aeronautics Board. The federal agency refused to permit National and Eastern Air Lines to offer special roundtrip excursion fares from northern cities to Florida points at only one and one-third times the regular one-way fare during the off-season between May 15 and Oct. 31.

CAB said the roundtrip rate of 133 percent of the standard fare would be discriminatory, and declared comparable excursion tariffs effective last summer had diverted considerable regular-fare traffic. The Board indicated it might approve summer excursion fares equal to 150 percent of the standard one-way fares if the special rates apply only from July 5 to Aug. 30 and carry a 21-day limit.

National will continue to offer its New York-Miami coach service during the summer and plans to refile its application for excursion fares.

IATA Seeks Standard Visas

Means of further streamlining immigration and customs formalities for bona fide tourists and businessmen traveling by air through the Mediterranean and Far East areas was sought by members of the International Air Transport Assn. during a conference in Cairo.

Revision of visa forms has been suggested in IATA to make sure that the information they carry will be more

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One of the things about which we pride ourselves most at Van Dusen is our intimate knowledge of aviation and flying needs which goes back quite a way. For instance, only old-timers will recognize Van Dusen's first airplane, an Aeromarine Klemm of early 1930 vintage shown in photo above.

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easily understood despite language differences. International carriers are responsible for validity of a passenger's visa granted by the country of destination. If there are any mistakes the carrier must bear the expense of returning the traveler to his point of origin.

An international agreement on documents and procedures required of airlines by governments for transit of planes, passengers, crews, goods and supplies through their territories was put into effect by member states of the International Civil Aviation Organization last fall. But deviation from ICAO standards was permitted.

Fuel Consumption—DC-6 vs. Jet

	Distance	Speed	Altitude	Fuel
DC-6	2000 mi.	300 mph.	20,000 ft.	2300 gal.
	2000 mi.	200 mph.	5000 ft.	2000 gal.
TURBOJET	2000 mi.	400 mph.	35,000 ft.	4500 gal.
	2000 mi.	200 mph.	5000 ft.	11,000 gal.

Jets No Traffic Control Problem

ATA's navigation expert says turbine transports will speed solution of present questions, not add new ones.

Arrival of jet transports on the commercial air transportation scene probably won't require radical changes in air traffic control planning, but it will add a new note of urgency to solution of existing problems.

That's the opinion of Sam Saint, director of the Air Transport Assn.'s Air Navigation and Traffic Control division. While he believes the jet will put our future air traffic control system to the acid test, he sees no reason why the new aircraft can't be handled in conjunction with slower, propeller-driven planes.

► **Fosters Sound Approach**—Certain special considerations demanded by the nature of the fuel-hungry jet transport will help screen out unsound approaches to the traffic control problem, Saint told the Society of Automotive Engineers' National Aeronautic Meeting last week in New York. "The jet engine is our best insurance against taking a wrong road in air traffic control development," he declared.

The ATA expert said it is clear that jet-powered transports cannot be operated economically under the present traffic control system, with its uncertainties and frequent delays. The jet demands a complete solution to the traffic control problem, and this same solution should also be best for propeller-driven planes.

► **Compared to DC-6**—Saint compared the DC-6 to a turbojet in the same general category to point up the latter's special problems.

A DC-6 can fly at 2000 ft. or 20,000 ft. and cruise at below 200 mph. or above 300 mph. without great change in economy of operation. On a 2000-mile flight at 300 mph. cruising at 20,000 ft., the DC-6 would need about 2300 gal. of fuel. For the same length flight at 200 mph. and 5000 ft. altitude, the DC-6 would save around 300 gal.—or a difference in allowable payload of 1800 lb. favorable to low altitude.

It's a different story with a jet in the DC-6 category. To fly such a plane 2000 miles at 35,000 ft. at 400 mph. requires about 4500 gal. of fuel.

But to fly the jet 2000 miles at 5000 ft. at 200 mph. requires about 11,000 gal. (66,000 lb.) of fuel—considerably more than the plane is capable of carrying. Thus, Saint observed, the jet requires nearly 19 tons more fuel to make the same flight at the lower altitude and lower speed. Its lack of flexibility means that air traffic control tolerances must be tighter.

► **Holding Problems**—Besides the higher rate of fuel consumption en route, the jets are handicapped by having only a small margin of holding fuel. Saint estimated that a comparable jet burns four times as much fuel while holding as a DC-6.

The jet is, however, able to slow down on entering the terminal area, and can fly through the final approach patterns at the same respectable slow speed used by other planes. If required to hold, it can do so at a speed well below 200 mph. with a reasonably small turning radius.

"It is not necessary," Saint emphasized "to visualize a momentarily blocked runway diverting a stream of 500-mph. airplanes in great swinging arcs across the sky. But the jet must have reasonable assurance of prompt landing on arrival at its destination. If the originally intended flight path or airport is blocked for unexpected reasons, the jet must be diverted quickly to a suitable alternate field."

► **Minimum Delays**—By 1960, if proper air traffic control plans are carried out, a jet should be able to make a three-hour flight from Dallas to New York with the promise of no more than ten minutes delay for landing, Saint declared. He envisions each jet receiving a priority number on the basis of the flight plan submitted.

If the jet is early, it will be forced to wait its turn in a holding pattern. If it is late, there will be no penalty, and slower conventional planes will be taken into the approach system ahead of it to keep the runways in full use.

Saint said that within five to ten years the airlines believe improved airways and landing aids will permit 40 landings and 40 takeoffs per hour on a dual runway airport, even when there is only a 100-ft. ceiling. This average of one landing or one takeoff every 45 seconds is more than double the best that can be done today.

Stated another way, the airlines by 1960 hope to move 3600 passengers hourly into and out of an airport in weather thick enough to slow highway traffic.

Frontier Airlines Formed by Merger

The nation's largest feeder, formed by merger of Monarch Air Lines, Challenger Airlines and Arizona Airways, will operate under the new name of Frontier Airlines.

Last link in the sprawling Rocky Mountain area short-haul system was forced recently when the Civil Aeronautics Board approved the consolidation of Monarch and Arizona Airways. Monarch's acquisition of Challenger was approved last December.

CAB's sanction of the Monarch-Arizona merger was on condition that MAL show within 30 days its financial ability to inaugurate and maintain service over the consolidated feeder routes.

► **Terms Listed**—The merger agreement provides that Monarch acquire all outstanding stock in Arizona in exchange for 6000 shares of MAL stock and assumption by Monarch of $150,000 of Arizona Airways' liabilities. Arizona was awarded a three-year feeder certificate in June, 1948, but never inaugurated service because of financial difficulties.

CAB authorized Monarch to extend its present route from Gallup, N. Mex., to Winslow, Ariz., to form a connecting link with Arizona's system. No service will be instituted over Arizona's Phoenix-Yuma link pending outcome of the reopened CAB case on additional California-Nevada service.

Opposition to the Monarch-Arizona merger was expressed by CAB member

Harold Jones in a dissenting opinion. He said that whereas Arizona was certificated in 1948, there was insufficient public interest by people of the Southwest in the proposed system to obtain adequate financing for its operation.

▶ **High Cost**—Jones asserted that the cost to the government of the merged Monarch-Challenger-Arizona system will be at least $3 million annually, possibly higher. He indicated that the consolidated Rocky Mountain feeder can hardly be called a supplemental local system since it will comprise 4941 certificated route miles from Mexico almost to the Canadian border. It will be larger than the trunk-line operations of Continental, Colonial, Inland, Mid-Continent, National, Northeast and Western, and the domestic system of Braniff.

Jones said CAB has spent over $40 million to date in mail pay alone on its feeder experiment. He added that the Board no longer has a common understanding of just what the feederline experiment is, what it can be expected to prove, or its cost to the government.

Tito Turns From East to West

Yugoslavia trying hard to qualify for U. S. aid to build transport network, but it's a tough problem.

By John J. Christie

(*McGraw-Hill World News*)

Belgrade—The Yugoslavs are going bravely ahead extending their commercial air ties with the west, even if they don't know where the next plane or engine is coming from.

Negotiations are well along with the Italians, French and Swiss, and others are in the offing, following implementation of the politically significant air pact which was signed with the U. S. on Dec. 23.

▶ **PAA Aid**—In fulfillment of the U. S. agreement, the Yugoslavs have managed to provide radio beacons and a minimum of other communications equipment to accommodate Pan American Airways. PanAm save some 350 miles by flying from Munich across Yugoslavia to Istanbul. The agreement provided full fifth freedom rights for U. S. carriers but commercial field facilities are inadequate for four engine planes.

JAT (Yugoslav National Airlines) has inaugurated a twice-weekly Frankfurt-Belgrade service in pursuance of rights granted for landings in U. S.-occupied Germany and Austria. Cabotage for a Munich stop on one of the weekly flights also was granted by the Civil Aviation Board of the Allied High Commission.

Actually, the first western air connection was established in November by an interim agreement with the Swiss. This pact, now in process of re-negotiation, is implemented by a weekly round trip by JAT and another by Swiss Air between Belgrade and Zurich.

▶ **Expansion Urge**—Only a country with guts enough to defy the Kremlin would be making such a bid to extend its international air service as the Tito regime now is doing. Here's why:

• **Best estimates** indicate the Yugoslavs have only about 14 DC-3s at this writing. And, at least one of these can be counted upon as marked for cannibalization.

• **JAT already is saddled** with a flourishing domestic service. There are daily flights between Belgrade and Zagreb and daily but one between the capital and Titograd. And, there are other points served irregularly.

So Tito is really on a desperate shopping tour. He'll take all the second-hand DC-3s he can get. For extension of international service westward is an important political prestige point at this time.

▶ **No Dollars**—The U. S. in January cleared the way for civil aviation equipment to be exported to Yugoslavia. But this has been of little practical help so far due to the condition of Tito's pocketbook. Only small orders for engines and parts have been eked out of dollar exchange earnings. No way has been found yet to meet repeated requests for dollar credit for civil aviation requirements.

Still the Yugoslavs and those U. S. officials intimately concerned with sustaining Titoism, are hopeful that the U. S. will be able somehow to make at least a few discarded DC-3s available in the near future. Meantime, the Yugoslavs probably can obtain some equipment from western European countries and possibly Britain under terms of forthcoming air agreements or through the medium of bi-lateral trade and payments arrangements.

▶ **Facilities**—The commercial airfield serving Belgrade is at Zenum, about three and a half miles from the center of the city. It has a grass runway about 4500 ft. long and 250 ft. wide. Two-engined aircraft can be handled satisfactorily but the landing of a DC-4 would be possible only under limited conditions.

New radio beacons at Belgrade and Zagreb, installed for the Pan Am flights, are high-powered Lorenz equipment of unknown origin. And there is air-ground radio telephone.

Beacons are switched on only when a flight plan has been sent to flight control at Belgrade. There is a 24-hour manual radio telegraph service for receiving this information.

A new international airport is to be built beyond Zenum at a site about seven miles from the center of Belgrade. On paper, it is a grandiose scheme charcteristic of the regime's Five Year Plan. Even a subway connection with the center of the city is planned eventually.

Of immediate concern is the first phase of the long-range development program. This calls for completion by mid-1951 of a 10,000-ft. instrument runway, with both GCA and ILS equipment.

The Yugoslavs at present aren't equipped to perform more than third echelon repairs. They have no capacity for depot repair work. Engines were sent to Czechoslovakia for overhaul prior to the Cominform break, but now go to Holland.

Though poor in civil aviation equipment, the Yugoslavs have other aviation assets worth mentioning. One is cadre of competent war-trained pilots, who served with a number of national air forces. The other is a good safety record, only one fatal crash having occurred since the war.

▶ **Commie Freeze-Out**—Pan Am and civil aviation officials concerned with the implementation of the recent agreement with the U. S. report speedy and competent cooperation by the Yugoslavs in meeting requirements.

There is very little remaining of Yugoslavia's air connections with the satellite area. A Czech twice-weekly Prague-Belgrade-Sofia run is the only remaining regular service.

Prior to the Cominform break Yugoslavia had air agreements with all members of the Soviet bloc, although the ones with Poland and Romania never were implemented. Air agreements were broken or mutually terminated with Albania and Bulgaria. Hungary ceased to exercise its rights some time ago under a pact which expired Feb. 18 and was not renewed.

There was no air agreement with Russia but the Soviets had controlling interest in a joint airline enterprise known as JUSTA. Tito ordered this dissolved after his bolt from the Kremlin. Unfortunately, the Russians were supplying the planes, a fleet of nine IL-2s, and of course withdrew them.

Tito has given the Russians a brush off since then. At first, the Soviets had blanket permission covering flights from Moscow to Tirana via Belgrade. This was reduced to a monthly basis, then weekly and now for each flight. Only

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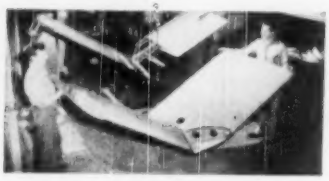
NEWS NOTES

Among the shortest wings used on any air-borne Air Force equipment are those being made, surprisingly enough, at our College Point plant. Mounted on the thirty-foot life boats which Edo is building for Air Rescue Service, these wings have a span of only nine feet.



These clipped wings are used to stabilize this ton-and-a-half air rescue boat when being cast loose from B-29 search aircraft for which the boats were designed. Once clear of the B-29 a huge Pioneer parachute, 100 feet in diameter, takes over and the boat is dropped gently into the ocean. The wings are then jettisoned by survivors once they're safely aboard.

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occasionally does a Soviet plane fly over the country to Albania or stop at Belgrade to deposit a diplomat.

Amber for Red

United Air Lines has received Civil Aeronautics Board permission to conduct a six-months experiment with amber rear position lights instead of red on some of its DC-3s.

Like other airlines, UAL has been operating its transports with rear position lights emitting alternate red and white flashes. The experiment, to be conducted with six planes, provides for replacing the red lens on the rear position light with an amber one.

United believes the amber flash in lieu of red will permit night-flying aircraft to be identified more readily at greater distances and will eliminate the confusion now existing between the red wing-tip light and the red rear position light. Following the six-months test period, during which flight personnel of other aircraft will have the opportunity to observe the experiment, United will submit its findings to CAB and CAA.

CAB Whittles Away At PAA Mail Pay

Pan American Airways is experiencing severe financial headaches as a result of the Civil Aeronautics Board's increasingly hard-boiled attitude toward mail payments.

Latest jolt to PAA is a CAB order telling the carrier, in effect, to show cause why nearly two-thirds of a reported $10,077,000 break-even mail pay need on Latin American routes should not be disallowed. Unless Pan American and CAB get a lot closer together on mail pay requirements, some of the tentative profit figures the carrier has on its books for past periods may become deficits.

► **Figures Trimmed**—Here's the way CAB analysts slashed away at the $10,077,000 mail pay figure which PAA says is required if it is to break even for the year ended last Sept. 30:

- $1,230,000 deducted for "unreasonable losses" resulting from operation of all-cargo services which CAB thinks were not justified by public need. These all-cargo flights, the Board declared, diverted cargo which normally would have helped build up loads on combination passenger-cargo flights.
- $4,972,000 deducted for losses stemming from operation of excess capacity. CAB suggested that PAA's Latin American division had made flights above the number justified either by the overall demands of the passenger-cargo-mail traffic available or by the minimum requirements of adequate service.

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• $400,000 deducted by adjusting the depreciation on PAA's Convair-Liners from a five to a seven-year basis.

In disallowing losses from the allegedly uneconomic all-cargo flights, CAB reiterated a policy laid down last year in orders affecting Panagra and Pan American Atlantic division mail rates. Despite the disallowances, CAB's proposed new mail rate would give PAA $2,775,000 more revenue during 1949 than the old one.

▶ **Profit Allowance**—Basing its findings on figures for the year ended last Sept. 30, CAB directed PAA to show cause why $7,225,000 shouldn't be the fair and reasonable temporary mail pay for the Latin American division during calendar 1949. This $7,225,000 includes the CAB-recognized $3,475,000 break-even mail pay need (instead of PAA's $10,077,000 figure) plus an allowance of $3,750,000 which, according to the Board, represents the amount required to yield the carrier a 7 percent profit on its investment after taxes.

Since PAA indicated it needed about $10,077,000 merely to break even, the $7,225,000 total specified by CAB presumably would result in a $2,852,000 loss for the year rather than a $3,750,000 profit. CAB has proposed a 33-cents-a-plane-mile mail rate for 1950 which would yield PAA's Latin American division about the same mail revenue as specified for 1949.

PAA has the right to protest the temporary mail rates proposed by CAB. And the Board, in fixing a final mail rate, may make further adjustments in its temporary figures.

Texas Feeder Bids for Copter Mail Service

Central Airlines, Fort Worth feeder-line, has put in its bid to operate helicopter-mail service in the Dallas-Fort Worth area.

The proposed route would run between Meacham Field, Fort Worth, the main post office in downtown Fort Worth, Fort Worth International Airport (now under construction midway between Dallas and Fort Worth), the main post office in downtown Dallas, and Love Field, Dallas. An alternate routing was asked to permit operations from Love Field direct to Fort Worth International Airport on the return trip.

Fort Worth International Airport is slated for activation some time in 1951. Central hopes the Civil Aeronautics Board will approve its helicopter application before the field's opening date.

Keith Kahle, Central's president, says that if his company is certificated for the helicopter mail service it would

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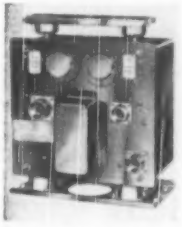

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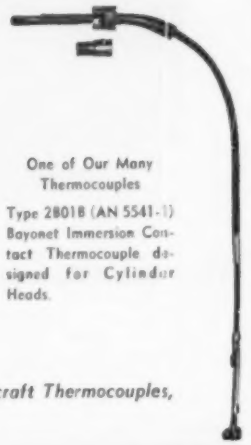

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ask for the right to carry passengers when suitable helicopter transport equipment becomes available. Central now operates Beech Bonanzas over its certificated feeder routes in Texas, Oklahoma and Kansas.

SHORTLINES

► **Air Line Dispatchers Assn.**—Has negotiated contract with Monarch-Challenger Air Lines providing wage scale ranging from $355 monthly to start to $515 during the sixth year of service. Beginning Apr. 1, 1951, the scale will range from a starting $375 monthly to $525 during the sixth year and $550 during the seventh year.

► **Air Transport Assn.**—Is preparing ammunition to fire back at railroad interests which have been attacking airline subsidies before a Senate Commerce subcommittee. Sidney S. Alderman, general counsel for the Southern Railway System, ripped into airline subsidies in a 78-page statement which said the airlines could no longer point to an "infant industry" justification for getting: 1. mail pay far in excess of fair compensation; 2. free use of beacons, weather services and airport control towers; 3. use of public airports at charges below cost; 4. benefit of government financing of aeronautical research. Alderman urged abandonment of uneconomical air routes.

► **All American**—Is joining the growing number of carriers painting the top of their planes white to reduce interior heat during the summer, an idea pioneered by UAL about three years ago.

► **Arctic-Pacific, Inc.**—CAB has rejected the Seattle nonsked's application for classification as a noncertificated cargo carrier under Part 295 of the Board's Economic Regulations.

► **Braniff**—Target date for inaugurating the carrier's service to Buenos Aires is now May 15.

► **Capital**—Hit an all-time high for Easter week-end business.

► **Civil Aeronautics Administration**—Four British aviation specialists have been brought to the U. S. on a three-months Marshall Plan study of CAA's airways traffic control system. British group will be based at Chicago Municipal Airport for the bulk of its training but will also visit LaGuardia Field and probably Kansas City. On their return home, the British specialists will serve as a trained nucleus to help install in the United Kingdom the single system of airways control CAA is advocating for international use.

► **Colonial**—Reports net loss of $318,715 on total operating revenue of $5,610,386 in 1949, compared with $261,030 loss on $4,993,834 revenue in 1948.

▶ **Eastern** — President E. V. Rickenbacker, in his recent annual report to stockholders, criticized the "unfair competition of charter and nonscheduled operators; the certification of new air freight carriers; and the pending certificate applications of air coach lines." He said present airline load factors are low enough to permit a sizeable increase in traffic volume without increasing the number of planes, flights or carriers.

▶ **Robinson**—CAB has increased the feeder's temporary mail pay to $756,000 (about 80 cents a plane mile) for the period from Sept. 10, 1948 (when certificated service started), to Dec. 31, 1949. Base rate of 60 cents a plane mile was set for Jan. 1, 1950, to June 30, 1950, and 50 cents thereafter.

▶ **Trans-Canada**—Canadian Trade Minister C. D. Howe has told a parliamentary committee investigating TCA's deficits that it would be five years before the carrier makes a profit on its Atlantic operations.

▶ **Transocean**—The uncertificated carrier's subsidiary, Transocean Engineering Co., has been awarded a $73,500 California State Highway Commission contract for bridge construction. TEC was formed by the airline to engage in general construction work, with emphasis on airports and installation of air navigation and lighting systems.

▶ **TWA**—Has announced reduced specific commodity rates for trans-Atlantic shipments.

▶ **Western**—Reports a net loss of $56,970 during the first two months of 1950 —well below the $122,632 deficit shown for the same period last year. Company was in the black during March and hoped to be near the break-even point for the quarter.

CAB SCHEDULE

Apr. 24—Prehearing conference on CAB's investigation of unauthorized operations by Metropolitan Air Freight Depot, Inc. Postponed from Apr. 18. (Docket 4319)

Apr. 24—Oral argument in Florida trunkline case. (Docket 2215 et al)

Apr. 26—Hearing on BOAC's request for New York-Bahamas route. (Docket 4389)

May 1—Prehearing conference in Wiggins Airways route case. (Docket 52-401E-1)

May 4—Oral argument on service to Springfield, Mass. Postponed from Apr. 17. (Docket 3748 et al)

May 8—Hearing on case involving American Airlines' Los Angeles-San Francisco cargo flights. (Docket 4211)

May 15—Hearing on CAB's investigation of New York-Miami daylight coach service. (Docket 4302)

June 12—Hearing on applications of TWA and American Overseas Airlines to suspend service at Philadelphia on trans-Atlantic flights. (Docket 4228)

June 12—Hearing in reopened case on additional California-Nevada service. (Docket 2019 et al)

June 19—Hearing on CAB investigation of Northwest Airlines' tariff practices and uncertificated operations of Fly Freight, Inc., and Sterling Freightways. (Docket 4290)

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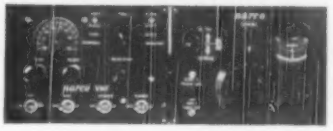

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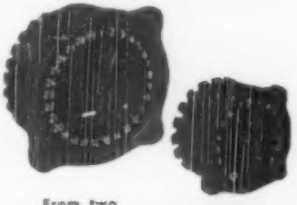

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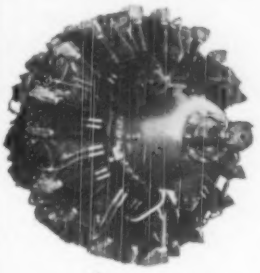

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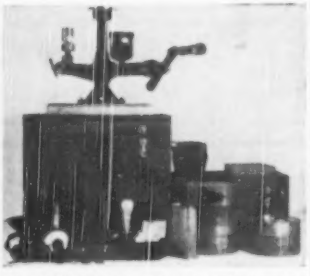

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LETTERS

ILS Double Check

We read with interest the article entitled, "GCA Check on ILS Aids UAL Landing" in AVIATION WEEK Mar. 13. We have taken particular interest in the paragraph entitled, "Double Check Wanted."

For your information, we were authorized for use of ILS by CAA on Jan. 27, 1950, the basis of this authorization being on the operation of a dual installation.

The dual installation consists of two independently operated glide slope and localizer receivers, the pilot's cross-pointer being used on one set of equipment and the second set of equipment connected to the co-pilot's indicator.

Our adoption of this system, we understand, was the first domestic application of a double check method. We are not fortunate enough to have GCA available at the six airports where ILS landings are authorized on our system.

Our reasons for using this method were: First, the increased safety factor in providing the pilot with a double check with the co-pilot's equipment, at all times; a secondary reason was economic, for through the adoption of this system we were able to eliminate the purchase of expensive test equipment at our terminating stations, and the cost of trained personnel to operate same.

We have found that our pilots have whole-heartedly accepted this installation and have placed a great deal of confidence in the method we are using.

We have also found that our first month of operations using ILS equipment has saved Southern Airways, Inc. enough in operation cost to pay for the initial investment which was required for installation of this system.

E. A. BOSTELMANN
Supt. of Communication
Southern Airways, Inc.
Atlanta, Ga.

Praise

. . . We appreciated the excellent job Irv Stone did in preparing the AVIATION WEEK article on our new ram jet laboratory.

KENNETH C. MEHRHOF
Public Relations Manager
Wright Aeronautical Corp.
Wood-Ridge, N. J.

Two Fighters

News that the Lockheed F-80 jet fighter is finally going out of production offers an interesting comparison between the USAF and the Navy, in my opinion. The grand old Navy still has the Vought F4U propeller-driven Corsair in production, while the Air Force is retiring an old and worn-out jet fighter from the production line!

It seems to me there's something wrong here when an Air Force jet fighter has already come and gone (as far as production is concerned) while the Navy still is plodding along building more piston-engine fighters of a type that flew long before Pearl Harbor —at this late date nearly five years *after* VJ Day!

I suppose the Navy has some very good technical reasons for still wanting the old Corsair, but I like better the Air Force's technical reason for no longer wanting the Shooting Star: later airplanes are replacing it on the production line!

K. S. B.
Anaheim, Calif.

Construction Critic

As a frequent patron of commercial airlines, I am quite dismayed over the fact that twice in one day doors of planes in flight flew open. Do you recommend all passengers keeping their seat belts fastened at all times to avoid possibility of a parachuteless parachute jump? Or should we wear parachutes on every flight?

If the airplane designers can't come up with a fool-proof door and fastenings, we'll be glad to turn the problem over to a construction engineer or a construction equipment designer.

Yours for planes that don't come apart in flight.

H. W. RICHARDSON, Editor
Construction Methods and Equipment
330 West 42nd St.,
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'Weeping for Rails'

I have just read with a great deal of interest your editorial Feb. 20, "Weeping for the Rails." It is a honey. And you have certainly given the bus a nice pat on the back. . .

EARL F. THEISINGER, Executive Editor
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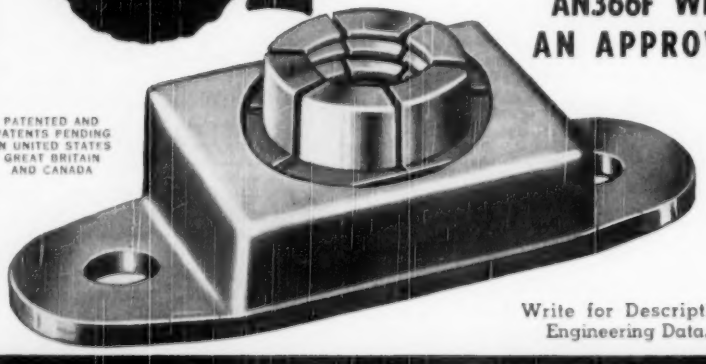

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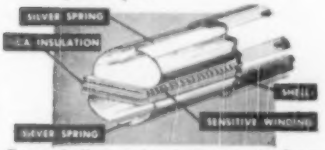

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Ever since aviation's earliest days, we have seen the stories about its heart-breaking accidents headlined across the front pages of the country's newspapers.

So we thought you old timers and the air transport industry would like to see how a big, black streamer headline about NO ACCIDENTS really looks. If ever we had adequate inspiration, it is completion by Colonial Air Lines last week of 20 years' operation without a fatality or serious injury to passenger or crew member.

That is a remarkable achievement. It deserves a banner headline and special editorial recognition.

We agree with Colonial Vice President Alfred M. Hudson, that "Accidents will always make bigger news than safety records, but Colonial's record is really newsworthy."

In this 20-year period, Colonial estimates it has flown 310,276,067 passenger miles. That is equivalent to moving nearly the entire population of Montreal—about a million persons—to New York City. Colonial says in these twenty perfect years it has completed 455,000 landings and take-offs and carried more than 1,204,800 passengers safely over its route system, which now comprises 3182 miles.

Congratulations came from the National Safety Council, the Air Line Pilots Assn. president, Dave Behncke, New York's Governor Dewey, and from airline executives.

"This achievement has been made possible because of the progressive thinking of everyone in the company," President Sigmund Janas said. "It is a record unequaled in air transportation anywhere else in the world. We will continue to take an intensive interest in the progress of the art of flying but we cannot lose sight of the fundamental consideration in all transportation and that is the safety of the passenger himself. No airplane should be permitted in commercial aviation which has not been thoroughly tested in advance and it is my sincere hope that the maintenance procedures laid down here in the United States for our transport companies will be adopted throughout the world."

Mr. Janas urged "prudence and judgment" before putting revolutionary types of transports into service. He recommended that no plane be permitted to engage in commercial airline passenger service before it has flown at least 3000 hours carrying freight or in other non-passenger operations.

Meanwhile, a phrase Mr. Janas coined in the 30s, "Safety is no accident," was adopted again for the second twenty years, and Mr. Janas commended all Colonial employes—especially flight crews, dispatchers, meteorologists,, mechanics and communications staffs. He said he hoped Colonial's safety record would serve to focus the eyes of the traveling public on the excellent records of all U. S. certificated airlines, both domestic and trans-ocean, which collectively made 1949 the safest year in the history of air travel.

Colonial's impressive record is important news in aviation.

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An advanced version of the famed Fairchild C-82, the new, larger and faster C-119 is the result of imagination and engineering skill and production ability.

The Air Force and Navy will use these aircraft for numerous transport assignments. C-119's will play a vital role in the ever-expanding field of military air operations. Here is another Fairchild "first" in air transportability!

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Armed Forces Day
20 May 1950

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